# THE GEOGRAPHICAL JOURNAL

Vol CXXII Part 1 March 1956

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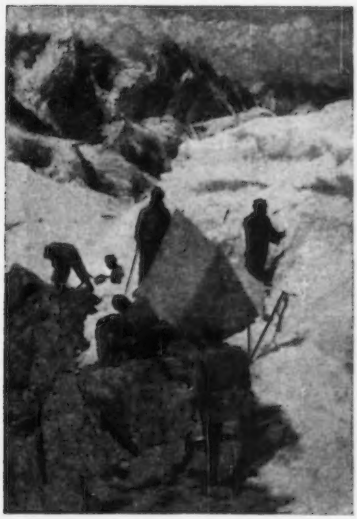

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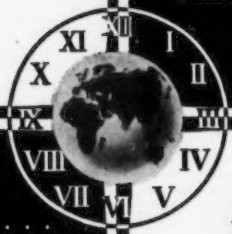

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## Programme of Meetings

### MARCH—JUNE 1956

*Monday March* 26 *at* 5 *p.m.*
SOME INVESTIGATIONS IN SOLIFLUCTION IN NORWAY. *By P. J. Williams.*

*Monday April* 9 *at* 8.30 *p.m.*
SOUTH. *The original film of Shackleton's Imperial Trans-Antarctic Expedition, followed by the new film of Duncan Carse's South Georgia Expedition,* GATEWAY TO THE ANTARCTIC.

*Monday April* 23 *at* 5.30 *p.m.*
GREAT BARRIER REEF and other Australian sound films.

*Thursday April* 26 *at* 5.30 *p.m.*
WEATHER MAP and other films for teachers.

*Monday April* 30 *at* 8.30 *p.m.*
ALPS AND ELEPHANTS. New light on Hannibal's march. *By Sir Gavin de Beer, F.R.S.*

*Monday May* 14 *at* 5 *p.m.*
OXFORD EXPEDITION TO NORTH EAST LAND, 1955. *By J. T. Hollin.*

*Monday May* 28 *at* 8.30 *p.m.*
TRANS-ANTARCTIC RECONNAISSANCE, 1956. *By Dr. Vivian Fuchs.*
Admission by special ticket only, to be applied for by post-card. No guest tickets will be available.

*Monday June* 4 *at* 5 *p.m.*
TOWNS OF CENTRAL AND EAST AFRICA. *By Robert Steel.*

*Monday June* 11 *at* 6 *p.m.* **(Please note time.)**
MOUNT WRANGELL EXPEDITION. *Colour films with commentary by Professor S. A. Korff.*
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*Monday June* 18 *at* 3 *p.m*
ANNUAL GENERAL MEETING.

### ANNUAL DINNER

The Annual Dinner of the Society will be held on Monday June 18, at the Dorchester Hotel, Park Lane (Ballroom Entrance) at 7.30 for 7.45 p.m. Evening Dress with Decorations. *Tickets :* Two pounds ten shillings each, including wines. *Applications for tickets* for Fellows and guests should be made in writing now and should be sent with remittance and names of guests to the Honorary Secretaries. Closing date for applications June 1. The principal guest will be General Sir Gerald Templer, G.C.M.G., K.C.B., K.B.E., D.S.O., Chief of the Imperial General Staff.

Light Refreshments will be served after Evening Meetings to Fellows, Associate Members and their guests.

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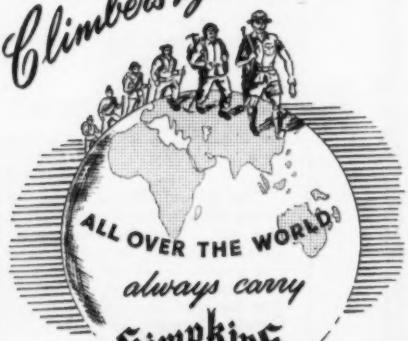


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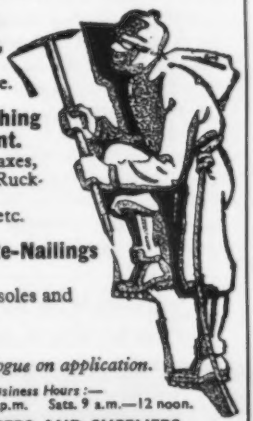

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The
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*Vol CXXII Part 1* *March 1956*

# KANGCHENJUNGA CLIMBED

CHARLES EVANS AND GEORGE BAND

CHARLES EVANS: Kangchenjunga, the third highest mountain in the world, lies 46 miles north-north-west of Darjeeling, from where there is a good view of the south-east face of the mountain with the east ridge on the right. The south ridge links Kangchenjunga to Talung Peak and Kabru; behind it the west ridge runs to Jannu, and between the west ridge and the south ridge lies the Yalung, or south-west, face. These features may be picked out from the photograph facing page 6. Beyond the west ridge is the north-west face, the scene of the international expedition led by Professor Dyhrenfurth in 1930, and described by Frank Smythe in 'The Kangchenjunga Adventure.' Beyond the east ridge is the north-east spur, the scene of Paul Bauer's heroic expeditions of 1929 and 1931.

The Yalung, or south-west, face had been neglected since 1905 (except for a brief visit by Crawford and Raeburn in 1920) until 1951 when Gilmour Lewis went there, returning with John Kempe in 1953. From Kabru, Lewis and Kempe examined the south-west face of Kangchenjunga. So impressed were they by its possibilities that they went back to the mountain again in 1954 and made a detailed reconnaissance of the lower part. The main features of the Yalung face are the Great Shelf, an ice shelf stretching across at about 24,000 feet, above which there is a *cirque* of rock which is called the Sickle. Immediately to the east of the Sickle is a sloping shelf, the Gangway, which leads up to the west ridge of the mountain. Below the Great Shelf the ice flows down under Kangchenjunga's west peak, Kangchenjunga West, from 23,500 feet to 20,500 feet (the Upper Icefall), and then bends south to continue its journey to the foot of the mountain as the Lower Icefall. This travels down until it reaches 18,000 feet. To the east of the Lower Icefall is Kempe's Buttress, and to the west the Western Buttress to the west of which again is the grave of Pache, who was killed in 1905 (see photograph facing page 3).

From Kempe's report two things were clear: first, that the likeliest way to the Great Shelf was by the route he recommended up his buttress and then, if possible, through the Lower Icefall in order to reach the lower part of the Upper Icefall; that was what we went out to try first: second, that if we got through the Lower Icefall and reached the Upper Icefall there was probably not much to stop us until we were very high on the mountain. It was clearly worth leaving England equipped to try for the summit.

When we were about to sail we heard that the Sikkimese, who regard Kangchenjunga as sacred, strongly objected to any attempt to climb it. From Darjeeling I went first to Gangtok, the capital of Sikkim, to discuss the problem. As a result of

our talk, although we had never intended to step into Sikkim (we were climbing the mountain from the Nepalese side), we agreed that we would only climb so far up Kangchenjunga as was necessary to make sure of a route to the top; and that, in any case, we would not tread the top or its immediate vicinity.

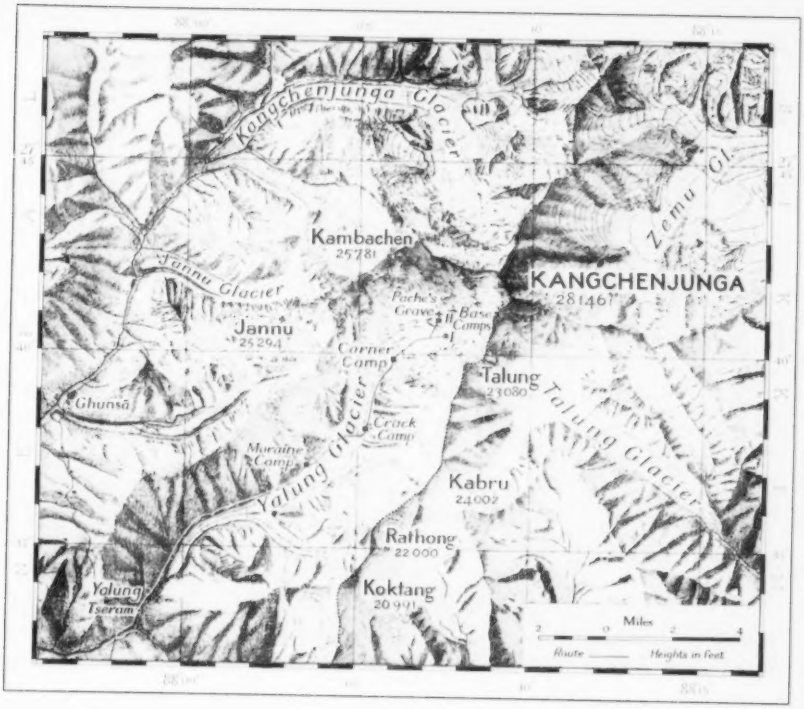
George Band will describe the march-in as far as the Lower Icefall, after which I shall describe the route to the Great Shelf. Band will then take over and tell you of the last climbs to near the top, in which he took part.

GEORGE BAND: By the middle of March we had all gathered together in Darjeeling and were anxious to get to grips with the mountain. We had assembled 300 porters to carry our 6 tons of stores over the ten-day switchback approach to Kangchenjunga, and the time had come to leave our very kind hosts, Mr. and Mrs. Henderson, tea-planters at Rungneet, 4 miles north of Darjeeling. For the first 25 miles of our journey we were able to use motor transport. From Darjeeling we went to Mani Bhanjyiang, whence the route lay along the Singalila ridge; this ridge runs due north, undulating between 10,000 and 15,000 feet, almost to Kangchenjunga itself, and divides the two independent states of Nepal on the western and Sikkim on the eastern side.

After a few days' journey along the ridge we came down, to avoid the snow, into the jungly steep-sided valleys of Nepal and finally went up the Yalung valley approach to the south-west face of the mountain. As Charles Evans has indicated already, previous expeditions had in 1929 and 1931 concentrated on the north-east, and in 1930 on the north-west faces.

On our first day's march we passed through a sad-looking hamlet called Kalipokri (or "Blackpool"), where we were greeted by a tremendous hailstorm, which seemed to set the tune for the weather on the approach to the mountain. The next evening we spent at Sandakphu, at about 12,000 feet, and in the early morning we awakened to look at a most wonderful view of Kangchenjunga. It was extremely cold, so we went back to bed again; but shortly afterwards we set off, aiming to get in the majority of the day's march in the cool of the morning. About 9 o'clock we stopped for breakfast then continued until we reached the end of the day's stage in the middle of the afternoon. We were travelling in two groups with 200 porters in the first and 100 in the second, many of them barefoot, and all lightly clad. We dropped down some 8000 feet on this second day of our march, to Chyangthāpu at 4000 feet above sea level. Lower down the valleys are hot, humid and shadeless, with the steep hillsides cut into terraces for the growing of grain. A short while after our descent we met a group of children; one, a boy smoking a pipe which must be the dream of pipe-smokers who have been offered a fill by a friend—one could get about 3 lb. of tobacco into the bowl.

All next day we padded along beside the little terraced fields, a feature of the countryside offering the only level spot for a camp as we marched through the valley. I remember noting the gorgeous flowers on either side of the route, as well as birds with plumage as colourful as their names suggest: scarlet and yellow minivets, long-tailed tree pies, black drongos and red-cheeked bulbuls. Two days from Phalūt we reached the village of Khebang and were fêted by the local population, all dressed in their Sunday-best. As we passed into the village under an archway of bamboo, garlands were thrown around our necks and children sang songs and sprinkled scented water over us. We signed the visitors' book and, on having a look round, decided to breakfast here; a tarpaulin was laid out and we sat around at a very solemn meal.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Corner Camp
Talung
23080
Talung Glacier
Ghunsa
Crack Camp
Moraine Camp
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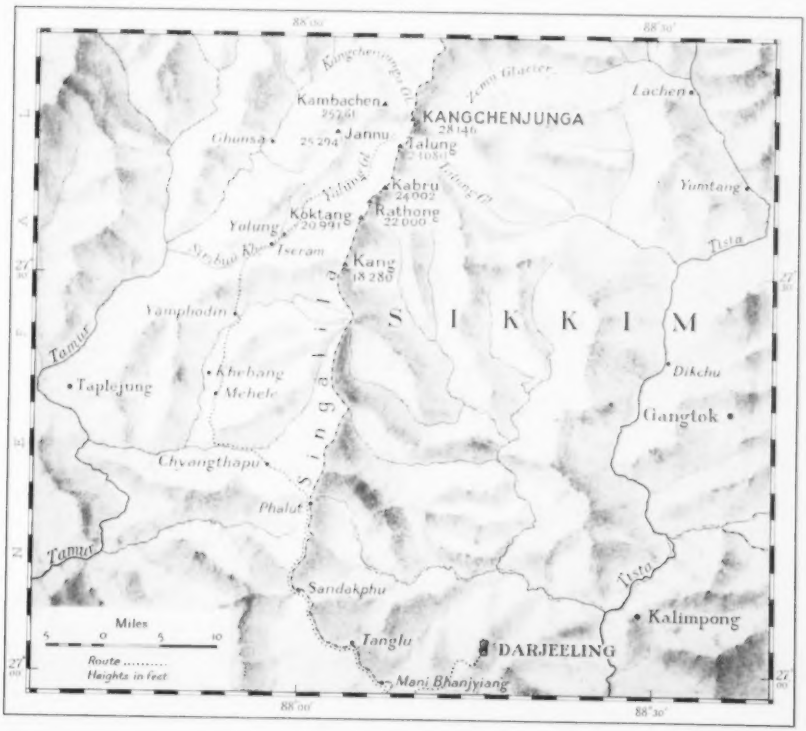
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*Kangchenjunga from the air, showing the camp sites, and the route followed as far as the highest point reached*

On an expedition of this size, passing through country in which the inhabitants only grow enough food for themselves, it is wise to carry all your own stores. We had the traditional English breakfast of porridge, bacon and eggs, mostly out of tins, and instead of toast we had biscuits and marmalade. After the meal, which generally lasted about two hours, we set off again, all wearing the same strange attire—gym shoes, a pair of shorts, and a beard, and of course carrying an umbrella. Two days above and beyond Khebang we had to climb up a long and excessively steep ridge in order to cross into the Yalung valley. On the ridge everything was dead and blackened because there had recently been a forest fire; and only the rhododendrons threw out their blooms in defiance. The rhododendrons are one of the sights of the Himalaya; their blossoms were blood red or scarlet, and as we got higher there were pink, yellow and white blooms growing on stunted bushes right up to 12,000 or 13,000 feet.

We went over into the Yalung valley and then had to cross the river flowing down from the glacier. The only bridge was a huge tree trunk thrown across from one bank to the other, covered with moss and very slippery. We helped the coolies one by one over this tricky crossing. One of us would tell the porter behind him to hold his hands, shut his eyes and walk over, while another of us stood waiting on the far side dangling a cigarette as a reward. That evening we camped in the jungle, lit great fires and, after a large supper, sat round feeling very contented. Close by, crouching beneath a rock, there was a ragged coolie singing over and over again the same tuneless lament. When we asked our Sirdar, Dawa Tensing, to translate the song for us he said it went something like this: "The sahibs are feasting like rajahs over there; here am I all alone in my poor corner but there is no backsheesh coming my way."

We carried on up the Yalung valley, and as we wandered in and out of the first winter snowdrifts we mentally thanked the 1954 reconnaissance for advising us to take this easier lower route. In the glades on either side of the path there were clumps of beautiful purple primulae, with the morning dew still sparkling on their petals. Higher up there was hardly any vegetation. We were hemmed in on one hand by the steep scrub-covered hillside, and on the other by the lateral moraine of the Yalung glacier. From this point on, the going was more difficult—too much for our Darjeeling coolies—and we had to rely only on our Sherpas. We set up our first permanent camp at Yalung (about 13,000 feet) and paid off the coolies, who were soon on their way back to Darjeeling. Meanwhile the Sherpas had collected a huge pile of firewood to serve for fuel at the lower camps for the next two months.

This camp was at the snout of the Yalung glacier, and from here we had to arrange a porter lift, covering some four days, up to the foot of the mountain; first, to "Moraine Camp," then across the glacier to "Crack Camp," and on the third day to "Corner Camp" before we finally reached Base Camp I at the foot of the mountain. Charles Evans took charge of the party which reconnoitred this route to base, while Jackson, Mather and myself were deputed to go to Ghunsā, the nearest village, to arrange for supplies of rice, barley and flour for the Sherpas. Hardie, our trained surveyor, and Brown were to survey some of the prominent features of the south-west face of Kangchenjunga, so that we would know how far we had to climb from one point to the next.

At Ghunsā we were very cordially received by the headman and his wife. In return for potatoes and the usual Tibetan tea we offered them cigarettes, and, as snow began falling steadily, a party began to brew up and they brought out their *chang* pots—wooden pots from which the local beer is sucked up through bamboo

straws. Knowing how particular we were about cleanliness, the lady of the household sluiced the straws very carefully with lots of water, but then dried them by drawing them under her armpit!

One of our tasks during this period was acclimatization. We camped at heights of about 17,000 feet and, wherever possible, climbed to about 20,000 feet, so as gradually to get our limbs and lungs used to the rarefied air at high altitudes.

On the return of our Ghunsā party to the camp we learned that Charles Evans and his party had had a difficult time carrying their stores up the glacier. Temperatures had been extremely low for the time of year, down to —18° C. at only 15,000 feet. They had found great difficulty in making a way across the hummocky surface of the Yalung glacier, the route over which the Sherpas would be carrying 60-lb. loads day after day. The Sherpas built cairns wherever they could to mark the route clearly. Two of our Sherpas returned to England with us, Dawa Tensing and Changjup, so when you see fanciful cairns in North Wales and the Lake District you will know who made them. In three days from Yalung they had reached Corner Camp, from which they could see the south-west face of Kangchenjunga.

As an example of the peculiar weather conditions we were experiencing during April and May I mention what happened to a big dome tent sufficient to hold twelve people, and which weighed 80 lb. Early one morning there was a shout: "The big dome's gone!" An enormously strong gust of wind had picked it up and carried it 200 yards, right round the Corner, without leaving a trace on the ground between. Two Sherpas who had been sleeping under it looked out of their sleeping-bags and were shaken to see the sky above them instead of the roof of the tent, but they put their heads back into their sleeping-bags and went off to sleep again.

On Easter Sunday (April 10) Charles Evans asked me to join him at Corner Camp, and from there we saw the south-west face of Kangchenjunga spread before us. We could see the Great Shelf, at 24,000 feet, which we were planning to reach by the Lower Icefall, and the Upper Icefall—the route suggested by Kempe's 1954 reconnaissance party. They had climbed Kempe's Buttress on the east side of the Lower Icefall: we wanted to repeat their climb and then attempt to get through the upper part of the Lower Icefall. Charles Evans's party had been busy making the route up the glacier to Base Camp at the foot of the Lower Icefall. They could have gone fairly easily along a trough on the right, under Talung Peak, but it was menaced by avalanches; so instead they found a way through the highly crevassed central section. Kangchenjunga stands to the south of the main Himalayan chain and so bears the brunt of the summer monsoon which blows up from the Bay of Bengal. Its precipices are plastered with snow and ice, and often many hundreds of tons would break off and thunder downwards, surging from one side of the glacier to the other. During the first twenty-four hours that Evans and I occupied Base Camp the weather was extremely bad, so we lay side by side in our tent and I passed away the time by using the stub of a pencil to tick off on the tent frame each avalanche as I heard it. After sixteen waking hours there were forty-eight ticks, which works out at a big avalanche every twenty minutes.

By this time so much work had been done by the climbers and the porters carrying stores there that Jackson was able to say proudly, "You could have wheeled a pram along it." Hardie and I now camped on Kempe's Buttress to examine the upper half of the Lower Icefall. We soon saw why last year's party had gone no further. The Icefall was separated from Kempe's Buttress by a deep rift, bridged

in one or two places by very shaky bridges consisting of partly refrozen ice blocks. Hardie did some steep and extremely tricky climbing across a vertical wall while I stood beneath a kind of gigantic crystal-blue chandelier of ice, with curious caverns and tunnels running through it. For two days we had some of the most exhilarating ice-climbing of our lives. On the third and fourth days Evans and Jackson came and joined us. The biggest problem was to find a way up out of a valley in the ice, the upper wall of which stretched across the icefall from one side to the other; the wall was about 50 feet high, sheer and generally overhanging. We could not find a break through it, so we decided that we would tackle it direct. We chose a place which was only vertical and about 40 feet high. Hardie and I spent about five hours climbing up 25 feet of this, and it had to be finished by "artificial" climbing, using double ropes and pitons. A rope ladder was soon placed there instead.

However, climbing of this nature was going to be very difficult indeed, especially for the Sherpas. If we were going to keep a route here, it would have to be open for several weeks with Sherpas carrying their loads over it. But we now had an alternative. While Hardie and I had been working in the Lower Icefall we had noticed a little snow gully, or small glacier, seaming the face of the Western Buttress. Here was one line of hope, and Evans let Hardie and me go round to the west side of the Western Buttress to see if we could find a route up to the top of the snow gully from the opposite side, and work our way down to the gully and through the last part of the Lower Icefall to reach the level snow haven separating the two great icefalls. For this stage of the expedition I hand over to Charles Evans.

CHARLES EVANS: The Western Buttress is really the continuation of a long ridge coming down from the west ridge of Kangchenjunga West. We now decided that whatever happened we would not use the Lower Icefall as a route, because it was too dangerous for the porters. We therefore put all our eggs into one basket, moved to Pache's grave, Base Camp II, where there was earth and moss at the foot of the Western Buttress, instead of the wilderness of stones, and of ice which was constantly cracking, even opening underneath the kitchen at our old base camp. Everybody was very much pleased with the change; especially when Hardie and Band came back and reported that they had been able to reach the future site of Camp 2, the plateau above the Lower Icefall. Joe Brown and I took over from them, and after coming up to Camp 1, in the narrows of the glaciated face, pushed on to Camp 2 to see if we could find a way up the Upper Icefall. From our new base camp at Pache's grave the route went up to Camp 1, then up to the Hump, and down onto the top of the Lower Icefall; from there it rose again to the Upper Icefall (see photograph facing p. 3). The only serious danger was from ice cliffs above the route between Base and Camp 1. However, this was a risk we had to take, and during the whole of the time we used this way only one avalanche fell from the cliffs, and that at night when there was no one about.

Camp 1 was pitched at 19,700 feet in a crevasse choked with snow, from which we looked across to the west, to Jannu. On the route over the Hump, not far from Camp 1, we reached a crevasse, 20 feet across and 60 feet deep, bridged only by a rather shaky-looking snow arch which sagged in the middle. We crossed the bridge to the vertical far wall, across which we were able to cut a traversing ledge to the right. A fixed rope was tied to pegs hammered into the ice; just beyond the end of the ledge was a slope covered with deep, soft snow lying over ice. There we put a fixed rope, in case some of the snow slid away. Soon after that, following a fall of

snow, a party coming up the slope before the snow had settled started a small avalanche, but fortunately kept their footing. Just below the Hump there was another long slope of snow, which at times was deep and unstable. Here, soon after occupying Camp 2, Joe Brown and I nearly started an avalanche. We were coming down about 100 feet below the top of the Hump. Joe Brown was in front, and presently he asked: "What was that?" I had heard nothing and went on in front to break the trail. I took two steps and a crack appeared in the snow at my feet. It was obvious that the whole slope was on the point of avalanching. We did not say a word, but turned and climbed back to the top of the Hump, faster than we ever climbed that part of the route before or after.

With use, this trail over the Hump, instead of wearing a deep furrow in the snow, became hard underfoot and built itself into a solid causeway, several inches above the surrounding soft snow. The pass at the top of the Hump is 20,500 feet and is a flat saddle cut by crevasses running parallel to the line of the ridge. We put a ladder across the widest crevasse to help the Sherpas on their way. From here we could look up towards the Upper Icefall leading to the Great Shelf and on towards the Sickle and the Gangway. Looking down, we could see the steep gully which led to the top of the Lower Icefall. From the ladder on top of the Hump the route went down the steep snow gully that we had spotted from the Lower Icefall. The Icefall was easier here than lower down, but to reach it, it was necessary to cross a bergschrund. Here at first there was a snow bridge, but soon, when it melted, we put an aluminium ladder across.

The climb from the bergschrund to Camp 2, that is, the last 400 feet of the Lower Icefall, was very slow and tedious. Here the air was still and muggy; and, although set amid snow and ice, the way here was hot. Those who had wound in and out of the ice blocks covered with snow, had climbed the rope ladder and then ploughed on up to Camp 2, reached that camp near exhaustion; resting every ten steps, they came into camp and flopped down breathless in the snow.

The wall at the top of the Lower Icefall was first climbed by Norman Hardie and George Band up an ice nose. It was not regarded as a suitable route over which porters could carry loads, and so we went a little further to the right of their route and hung down a rope ladder, which was later replaced by one of aluminium. Looking back from the level snowfield below the Upper Icefall we saw the Hump and the snow gully down which we had come; looking in the other direction from Camp 2 the view was of the Upper Icefall. This was our next problem, and Joe Brown and I spent a week here in intermittent snowstorms, exploring up amongst the seracs until we found a place at 22,000 feet for our Camp 3 on a platform 40 feet long by 15 feet wide, under an overhanging cliff of ice which sheltered it from snow sliding from above.

Between Camps 2 and 3 the going was simple until the end; here, just below Camp 3, ice cliffs barred the way, and we bore right to find a way up a gully leading to the ledge on which we pitched Camp 3. From camp we could look back to the top of the Hump, and on the level snowfield below we could see Camp 2. Some of our tents had been damaged in the early gales during April and we were now rather short of them, so we eked out our accommodation here by digging a cave in the ice. Half a dozen Sherpas came up each day with loads, and they would stay at Camp 3 to rest awhile and spend two or three hours taking turns in digging the cave. Though caves are rather laborious to make, they provide excellent shelter. When four or five people are inside with a Primus stove going, and rucksacks blocking the entrance, one can be very snug at night. Here, at 22,000 feet, we were

*Kangchenjunga from the Singalila Ridge*

*Kangchenjunga West Peak : Everest group in distance*

*Bridge over the Yalung*

*Snow bridge in the Yalung*

within striking distance of the Great Shelf; and now Hardie and I made a quick reconnaissance, using closed-circuit oxygen, to find a site for Camp 4, a way onto the Great Shelf and a site there for Camp 5. As a result of what we found, we made our plans for the final climb.

First, Tom Mackinnon and John Jackson were to take eleven Sherpas and carry loads to Camp 4, and then to Camp 5, which was for us much the equivalent of the South Col on Everest, although nearly 1000 feet lower. The first summit pair were to follow this carry at a day's interval, Joe Brown and George Band; Neil Mather and I, with four Sherpas, would accompany them. One or two days' behind us would be Tony Streather and Norman Hardie, with two more Sherpas. Jackson and Mackinnon started off and went up from Camp 3 to Camp 4. The slopes below Camp 4 are steep, and here there were several sections where ropes had to be fixed and much step-cutting done before the laden Sherpas could use it as a route. The journey from Camp 3 to Camp 4 is one of about 1600 feet. Camp 4 was just above a short wall on a curving dome of snow at 23,500 feet.

Coming up with the first summit pair, Neil Mather and I with four Sherpas arrived in the afternoon at Camp 4. There was no sign of Mackinnon and Jackson and their eleven Sherpas who were due back after their carry to Camp 5. We learned later that day that they had started very late. On the previous day John Jackson had had to go without his snow glasses and as a result had become snow-blind. He had spent a night in great pain, pain which has been described as being like having one's eyes full of powdered glass. They did not sleep all that night and in the morning Jackson could hardly see. In spite of efforts to persuade him to stay behind in camp, he insisted on taking his part in next day's carry; in the middle of the rope he could at least carry a load and encourage the Sherpas with him. They had a hard time going up the slopes from the Great Shelf to the Gangway because the snow was soft, and it was about 4 o'clock in the afternoon before, at last, they dumped their loads near Camp 5.

We waited at Camp 4 for their return. Three Sherpas arrived; then three more with John Jackson. Finally, only two men were still missing, Pemi Dorje and Tom Mackinnon. At last they appeared over the crest of a serac and came down the last slopes to our camp. Pemi Dorje had just fallen into a crevasse and been rescued by Mackinnon, and it was clear that they must both, as well as Jackson, stay the night with us at Camp 4. That night a blizzard started which swept the camp for the next two days and three nights, and made all upward movement impossible. On the morning of the third day it was fine again, although windy, and in the new snow we started up the Great Shelf towards Camp 5. In the course of the blizzard the weather side of the tent used to be piled up with snow which pushed the tent in, but the Sherpas soon swept away some of the snow to make more room inside the tent. The scene inside, when that sort of blizzard is going on, is chaotic; the lamp, if hung from the roof of the tent, swings and turns about as though on a small ship at sea. Every now and again somebody spills his tea or coffee, and gradually a scene of indescribable dirt and confusion arises.

On the fine morning of the third day we pushed on up the Great Shelf, making very slow progress because of the new snow. When just short of the camp site, we found that some of our stores for the camp had been swept away by an avalanche, and the remainder buried. We spent the last hour of the day digging them out. It was nearly night when at last we crawled into our sleeping-bags and settled down. We were at 25,300 feet and protected from avalanches by a small cliff. We had hoped to continue to Camp 6 the next morning, but after our exertions

the day before we were too tired to make the early start that was essential if we were to put Camp 6 as high as we wanted it to be. We therefore waited until May 24; on that day we began to get ready at 4.30 a.m., and at 8.30 a.m. we started. Early starts are not easy on the mountains, not because one cannot bring oneself to begin to get ready early, but because it takes so long to do even the most minor tasks.

In two ropes of four, we made for the lower end of the Gangway, and aimed for a snow gully between the rocks. We had looked at this stretch in photographs and reached the conclusion that it would be dangerous and difficult to negotiate unless there was good snow there. On reaching the Gangway, we found that the snow was the best that we could have hoped for—hard, and yet not too hard, firm enough to make a good step and yet soft enough to be cut with a single stroke of the axe. Soon we were going up the Gangway, aiming for a possible camp site at about 27,000 feet. It had seemed that we would be able to pitch camp on some rocks, but when they were reached they were found to be smooth. There was nothing for it but to scrape a ledge in the shallow snow beside the slabby rocks. On our way up the Gangway we had, one by one, run out of oxygen, and now we were too weak to dig at the snow until Band found that Tashi still had one-third of his oxygen unused. We supposed that at one of the rests on the way he had turned off his oxygen and, on starting again, had forgotten to turn it on, without noticing the difference! At 4 o'clock, after two hours' hard work, the ledge was ready and the tent was pitched. Mather and I and the four Sherpas said goodbye to Band and Brown, and went down to Camp 5 with the Sherpas.

GEORGE BAND: The other members of the Expedition had done magnificently for us by getting Camp 6 to close on 27,000 feet. We had hit rock in excavating the ledge for the tent, so it was really far too narrow and the tent looked very sorry for itself when pitched there with its outer part overhanging the extremely steep slope. The first thing Brown and I did was to decide which one should sleep along that outside edge; we drew matchsticks and unfortunately I lost!

At high altitudes one gets extremely thirsty, and all one's water must be melted from snow. Nevertheless, we made a good meal—orangeade made from crystals, then tea with lots of sugar in it. We had asparagus soup from a packet, a tin of lambs' tongues and mashed potato, and rounded it all off with a mug of drinking chocolate. We used a small amount of oxygen for sleeping. During the night fragments of snow kept slipping down the slope and bombarding our tent in its precarious position on the ledge, and I lay wondering what would happen if a really big lump broke away, or even a rock. But we survived without such a disaster, and luckily the weather remained fine.

Shortly after 8 o'clock on the morning of May 25, Brown and I were able to start off up the Gangway. We had previously examined the summit pyramid through our binoculars and we had realized that the original suggestion of going up the Gangway and then the west ridge was not a good one, because the ridge was extremely broken and difficult, consisting of several steep steps and an enormous cluster of pinnacles halfway. Instead, we decided to try to climb across the south-west of the face of the mountain, following a series of snow patches and then up steep rock and ice to join a subsidiary snow ridge which we might follow to the main west ridge just beyond the worst of the pinnacles. From there the final part of the west ridge itself did not look too bad.

That was our plan, but we had difficulty in deciding how far up the Gangway

we actually were, and so we were misled at first into going onto the wrong series of snow patches. Before discovering our mistake we had lost about an hour and a half, not only of time but also of precious oxygen. We had about four or five hours of oxygen when used at the normal climbing rate of 4 litres per minute, but if we turned it down to the lowest flow rate of 2 litres, we might make it last as much as eight or nine hours. So we returned onto the Gangway and turned our oxygen down to the minimum, and carried on as fast as we could without rests in order to make up the lost time. We found the correct series of snow patches, carried on along them and, when we reached the steep rocks, we took off our crampons and continued. We moved one at a time and with the improved oxygen apparatus were able to manage quite difficult rock climbing. Just above us there was a very steep ice slope, 60° in places, and Brown cut steps up it. It was extremely tiring. I had started off leading at first that morning, then we had a period of leading through. Now Brown had been in the lead for a while and when he offered to continue I was grateful. We eventually joined the subsidiary snow ridge which leads up to the main west ridge and, climbing the snow ridge, we gained the crest of the main west ridge just behind and on the east side of the worst of the pinnacles. We had been going for six hours without a rest, and so we thankfully sank down into a little hollow and had a quick snack of lemonade, toffees and mint cake. Looking back along the main west ridge, on which we were, we could see Kangchenjunga West a little under 28,000 feet.

Our situation was becoming somewhat critical. We only had two hours' oxygen left; it was 2 p.m., and I said to Brown, "We'll have to turn back by three otherwise we shall have to spend the night out." He replied: "We've just got to get up before then." Looking upwards, the west ridge was obviously easier for a period, and then we realized that our way would finally be barred by a smooth unbroken nose of rock. When we reached it, we went round the corner, up a little gully and there—in front of us—the wall was vertical, ending in a slight overhang, but seamed by a series of vertical cracks. Brown chose one of these cracks, and by a very fine feat of rock climbing, considering we were over 28,000 feet, he managed to force his way up to the top having turned the oxygen valve full on for the tremendous effort required. We still had no idea of how far we had to go, and so I was extremely surprised when from that position Brown turned round and shouted out: "George, we're there!" When I in turn climbed up and joined him, there in front of us, 20 feet away and 5 feet higher than the ground on which we stood was the summit, a gently sloping cone of snow. We had come as far as we were allowed. It was 2.45 p.m. on 25 May 1955.

Apart from the excitement of the success of a climb, I always think there is an element of sadness when yet another of the world's greatest peaks has been climbed for the first time. But with Kangchenjunga it will be slightly different; it will remain, always perhaps, an untrodden peak. From the point at which we stood we took photographs looking all round the mountain, though not being able to see to the east because that was hidden by the curve of the summit. The photograph we took to the south showed the chain of southern summits of Kangchenjunga, and all around were measureless acres of billowing clouds spreading right out across the plains to India. Looking to the west, the cloud sea that day was at about 20,000 feet, so that only the highest mountains of all stood out like rocky islands with the cloud waves lapping round about them. In the distance was the peak of Makalu on which our French friends had triumphed ten days previously. In the distance, 80 miles away, were Lhotse and Mount Everest. It was the view which Ed Hillary

and Tenzing Norkey had seen in reverse two years before. Looking down, we saw the long north ridge descending into the distance. One could see the summit of the north-east spur on which Paul Bauer and his Munich mountaineers made, in 1931, such great efforts. Twelve or thirteen miles distant were the dun-coloured highlands of Tibet.

There was no time to spare. We had to turn and go down the mountain as fast as we could. After an hour the oxygen gave out and we had to carry on without it, both feeling pretty tired. As I was crossing an unstable patch of snow the foothold beneath me broke and I slipped. Digging the point of my ice-axe into the snow I brought myself, as a mountaineer can do, to a stop; but the effort made me pant. Brown looked down and said: "George, don't do that again; it makes me tired just to watch you." We were guided into the tent at Camp 6 by the shouts of Hardie and Streather, who were now in occupation, ready for their own attempt. When we reached the tent they plied us with tea and soup. That night all four of us had to squeeze into that little tent on the narrow ledge. We did not bother to draw matchsticks to decide who should sleep in the outside position. They thought I knew all about it, so there I went. There were only two sleeping bags and Brown and I insisted on Hardie and Streather having them because they still wanted to repeat the climb next day. There was very little sleep for any of us that night.

The next morning Brown and I carried on down to Camp 5, leaving the way clear for Hardie's and Streather's attempt. They carried plenty of oxygen with them and we thought they might have a comparatively easy trip. Unfortunately they met with an accident; an oxygen cylinder broke loose from its frozen straps and slid off down the mountain side. They had to pool their meagre resources and carry on as best they could. When we had told them about the climb on the previous night our story of that final crack had lost nothing in the telling, and when they reached it they didn't like the look of it either. They thought there must be an easier way, and so they carried on, looked round the corner, and there was a perfectly easy snow ridge leading to our previous highest point. They sat there for an hour and Streather changed from one small oxygen cylinder to the next. Owing to an unnoticed leak, it was empty, and Streather had to make the whole of the descent without oxygen. It was a very tired pair that returned to Camp 6.

Meanwhile Charles Evans and Dawa Tensing had been waiting to meet the teams as they returned to Camp 5. On the morning of May 27 Charles was looking up at the mountain when he saw the figures of Hardie and Streather coming down, and as they came nearer he shouted out: "Are you all right?" They thought that a silly question, and did not reply. When the two climbers were a little closer to the camp, Hardie shouted out: "Who won the Election?" Charles Evans thought that an equally silly question, so he did not make any reply either.

By May 28 we were all off the mountain and gathered at Base. Here our jubilation at the double success of our Kangchenjunga reconnaissance was marred by some very sad news. Pemi Dorje, who had returned exhausted from his high carry, had seemed to recover after three days at Base Camp, but had then suddenly developed the symptoms of cerebral thrombosis. Despite all our doctor, John Clegg, could do for him, he died twenty-four hours later. So we buried him on May 28 near Pache's grave, under a rock on which the Sherpas carved his name and the Buddhist prayer: *Om Mane Padme Hum*—Hail to the Jewel in the Lotus. Sherpas and climbers all gathered together that night at the base camp from which we had the last view of Kangchenjunga, its highest crags turned to gold by the rays of the setting sun. We felt that the loss of Pemi Dorje was the one cloud on our happiness—our happiness

*Band and Jackson: Lower Icefall, upper part*

*Pitching Camp 6*

*Band traversing off the Gangway above Camp 6 (27,000 ft.)*

in finding against all expectations a route to the summit, and our happiness in becoming a team of firm friends, Sherpas and climbers, sharing in that success.

## INTRODUCTION

*Her Royal Highness the Duchess of Kent, Honorary President of the Society, was graciously pleased to be present at a Joint Meeting with the Alpine Club at the Royal Festival Hall, London, on the evening of 7 November* 1955.

Sir EDWIN HERBERT (President, Alpine Club) said: Your Royal Highness, My Lords, Ladies and Gentlemen—Once again members of the Alpine Club and Fellows of the Royal Geographical Society are met together to celebrate the successful accomplishment of a great piece of mountaineering and exploration. The Alpine Club takes particular pride in this achievement because the expedition began as an Alpine Club project, and our pleasure in it was increased by the fact that the Royal Geographical Society felt able to accept our invitation to join us, thereby continuing the happy and fruitful cooperation which had begun over Mount Everest.

About the actual climbing of Kangchenjunga, I offer a word of warning in regard to Charles Evans. He reminds me of a cocktail to which I was introduced in New York last week. It seemed quite innocent but produced the most remarkable results! But do not let that smoothness lead you to believe that this climb was an easy or simple proposition; in fact, Kangchenjunga presented one of the most formidable obstacles that any mountain has ever presented to any mountaineer. If the climb sounds smooth and almost easy, that is a tribute both to the skill of Charles Evans as a lecturer and also to his skill as a leader.

Secondly, we should not allow the success of the main expedition to blind us to the contribution made by the reconnaissance led by John Kempe, accompanied by Gilmour Lewis, which in 1954 found the way to, and the probable way up, the side of Kangchenjunga from which the climb was made. The two expeditions are, so regarded, really one, and the happy outcome is due to the efforts of both.

General Sir JAMES MARSHALL-CORNWALL: The Royal Geographical Society has great pleasure in welcoming here tonight Your Royal Highness—our Honorary President. When the Alpine Club in 1954 invited our Society to join with them in sponsoring the Kangchenjunga Expedition, we were continuing a partnership which had existed for over thirty years, the partnership which organized the successive Everest Expeditions, including the last and successful one.

But our Society's connection with Kangchenjunga goes back still further. Fifty-six years ago (in 1899) one of my distinguished predecessors—that great geographer and mountaineer, Douglas Freshfield—made, with Professor Garwood, the earliest reliable survey of Kangchenjunga and its approaches. This evening, however, we are concerned, not with the mapping of Kangchenjunga, but with its climbing.

Few mountaineers have ventured to challenge that formidable peak—the third, and possibly the second, highest in the world. Before this year all previous attempts had ended in failure—some in disaster. The first attempt was made in 1905 by a mixed French, Swiss and British Expedition, led by Dr. Jacot-Guillarmod. Six lives were lost and the mountain was considered unconquerable. Twenty-four years later, the Germans took up the challenge—Paul Bauer led expeditions in 1929 and 1931, and Dyhrenfurth led an international expedition in 1930, which included Frank Smythe. In 1937 a British climber, Cooke, in an expedition with John Hunt, only just failed to reach the North Col of Kangchenjunga.

These attempts were gallant failures; they served as stepping-stones for the final achievement.

Sir JOHN HUNT (Chairman, Joint Kangchenjunga Committee): The idea of attempting Kangchenjunga was very much in the minds of myself and other members of the

1953 Expedition to Everest during November and early December 1952, when we were still without news of the second attempt by the Swiss to climb Everest and we here were in the last stages of our preparations. It was natural, when we came back from Everest, that we thought Kangchenjunga might be our next venture; and that it might be worth pressing the Alpine Club to back the idea. This, coming at the same time as Gilmour Lewis and Kempe reported a possible route up the south-west face of Kangchenjunga, seemed more than a coincidence, and encouraged us to go ahead with plans for this expedition to Kangchenjunga.

It must be a source of great satisfaction to us all that the climbing of Kangchenjunga should have been so largely due to the enterprise and skill of British climbers. But it is worth remembering that this success, like so many others in this type of adventure, was built up, as the President of the Royal Geographical Society has said, by earlier failures. We are delighted to have with us tonight and to honour Paul Bauer, the leader of those two memorable German expeditions which attempted Kangchenjunga in 1929 and 1931. Kangchenjunga was not the only remarkable achievement in the sphere of mountain climbing in 1955. The French—who were so generous in their tributes to us when we in 1953 forestalled their attempt to climb Everest in 1954—climbed Makalu, the fifth highest mountain in the world, and we have with us tonight and are delighted to welcome Monsieur Jean Franco, the leader of that French Expedition to Makalu.

It is now my pleasant duty to introduce the members of the Kangchenjunga Expedition. George Band is a Cambridge geologist; Joe Brown, a builder's assistant from Manchester; Dr. John Clegg, doctor to the Expedition, is a lecturer at the University of Liverpool; John Jackson, a schoolmaster from Yorkshire; Tom Mackinnon, a Glasgow pharmacist; Neil Mather, a textile technologist from Lancashire, and Tony Streather, a Captain in the Gloucestershire Regiment of the British Army. Missing tonight, I am sorry to say, is Norman Hardie, a New Zealander and a civil engineer, who has decided to remain out in the Himalaya. Finally, Charles Evans, the leader of the expedition, who of course needs no introduction. This was his sixth expedition to the Himalaya, and I reckon that he must be the greatest expert now active regarding Himalayan affairs. He was my deputy on Everest, and it was most appropriate that he should have been invited by the Joint Committee which I was asked to look after, to lead this expedition; and how appropriate it was that he should have led the expedition to success. I now ask the lecturers to describe the climb.

*Charles Evans and George Band then delivered the lecture.*

# NORTHERN ELLESMERE ISLAND

GEOFFREY HATTERSLEY-SMITH

THE ELLESMERE ICE SHELF EXPEDITIONS of 1953 and 1954 were launched under the auspices of the Canadian Defence Research Board * and the Canadian Geological Survey, with the addition in 1954 of the United States Air Force Cambridge Research Center (A.F.C.R.C.) and the Snow Ice and Permafrost Research Establishment, Corps of Engineers, United States Army (S.I.P.R.E.). In the course of our work we came on a number of relics of our predecessors in the northern regions of Ellesmere Island, and, before describing the course of the expeditions themselves, it may be of interest to recapitulate briefly the history of exploration in these parts.

Hayes in 1861 appears to have been the first explorer to see the mountains of the north east corner of Ellesmere Island, from Lady Franklin Bay (his furthest north),[1] but it was another ten years before Hall looked for the first time on the north coast of Ellesmere Island. Hall's ship, the *Polaris*, wintered in 1871–2 in Thank God Harbour, where Hall died. Sledge parties were active on the Greenland side of Robeson Channel, but the north coast of Ellesmere Island was not visited.[2] In 1875 the British Arctic Expedition (Captain Sir G. S. Nares, R.N.) went north. While Captain Stephenson wintered his ship, the *Discovery*, in Discovery Harbour, Nares himself succeeded in forcing the *Alert* to winter quarters at Floeberg Beach near Cape Sheridan, the western portal of Robeson Channel. The latitude of 82° 30′ became the furthest northing of any ship under her own power in North American waters, and remained so until the U.S. icebreaker operations of 1948, although from 1905 Peary shared with Nares the credit of taking a ship thus far.

From Floeberg Beach the following spring Nares sent out man-hauling parties in the tradition of those days. By modern standards ill-equipped and inadequately fed, the northern party under Markham and the western party under Aldrich, with great resolution and an unflinching contempt for the elements and the deep soft snow, pursued their objectives, a "Farthest North" and the exploration of the north coast of Ellesmere Island. Markham returned from lat. 83° 20′ north of Cape Joseph Henry, but in order to reach this point he was obliged to travel 520 miles to make good a distance of less than 60 miles north-north-west of winter quarters; and he lost one man. He returned with the conviction that the North Pole would not be reached by travelling over the ice floes. Aldrich's journey is perhaps the more remarkable, for he reached Alert Point, 200 miles distant from winter quarters. Like Markham he returned with the finest margin between safety and disaster, but lost not a man. Scurvy forced Nares to abandon his plans for a second year and return to England, with the *Discovery* in company, in the summer of 1876.[3] [4] [5]

In 1881 Greely led the United States Expedition to Lady Franklin Bay, which spent two winters at Fort Conger on Discovery Harbour. The subsequent retreat southward of this party in 1883–4 was attended by disasters which have had few parallels in the history of Arctic exploration. From Fort Conger sledge parties were active inland, on the Greenland and on the Ellesmere coasts. A northern party,

* Geoffrey Hattersley-Smith is a member of the Geophysical Research Section, Defence Research Board, Canada, and this paper is published by permission of the Chairman of the Board. See end of paper for references.

consisting of Pavey, Rice and one Eskimo, set out by dog team via the coastal route in the spring of 1882 to better Markham's "Farthest North." They were forced back by an open lead a few miles north of Cape Joseph Henry, only narrowly escaping disaster. The same year a new "Farthest" was attained by Lockwood and Brainard, who reached Lockwood Ö on their great sledge journey along the north coast of Greenland. Later the same pair, on a sledge journey to the head of the valley leading into St. Patrick Bay and beyond, obtained a view of the 5000–6000-foot mountains of the eastern part of the United States Range, 20 miles away. Both were impressed by a great glacier lobe, ending in a high ice cliff on the level upland region below the mountains.[6, 7]

Peary, on his 1898–1902 expedition, took up winter quarters at Fort Conger, adapting Greely's old hut to his needs. In the spring of 1902 he made his first foray along the north coast of Ellesmere Island and his first attempt to attain a high north latitude over the polar pack. Travelling north from Cape Hecla, he reached lat. 84° 17′, before being forced by rough ice and open leads to turn back to Fort Conger.[8]

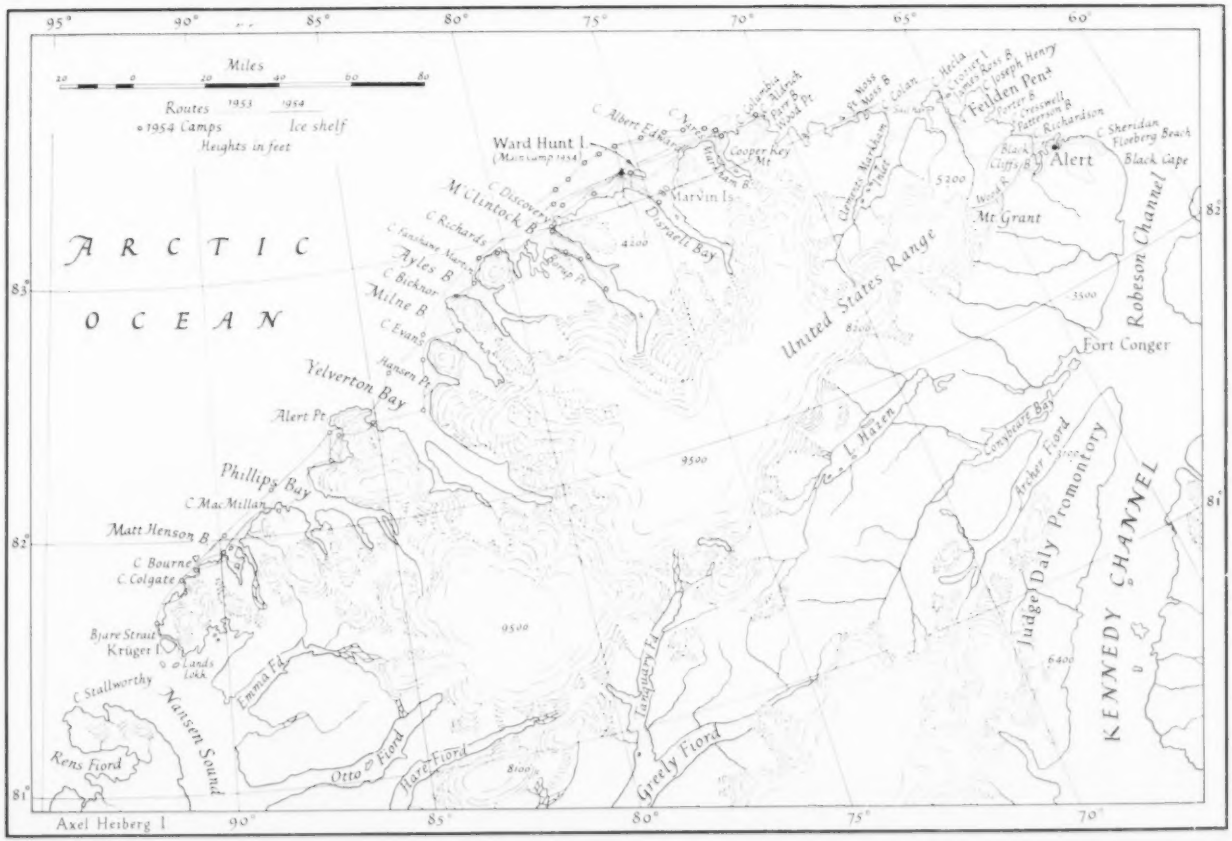
Peary came back to the region in 1905–06, when he wintered his ship, the *Roosevelt*, near Floeberg Beach. The following spring he reached lat. 87° 06′ with his Eskimo dog drivers and teams, north of Point Moss, before being forced back by open leads. He made land on the Greenland coast near Elison Ö, where a kill of musk-oxen probably saved the lives of the party. The ship was reached towards the end of May, and Peary delayed only one week here before setting out on June 2 westward along the coast, with the intention of linking the north Ellesmere coastal survey with the surveys of Sverdrup, who had worked north via Nansen Sound in 1898–1902. On June 28, Peary reached "Cape Thomas Hubbard" (now Cape Stallworthy), the northernmost tip of Axel Heiberg Island, after exploring the coastline between Alert Point and Lands Lokk, which was not covered by Aldrich's and Sverdrup's surveys. The return journey from "Cape Thomas Hubbard" was probably the hardest journey Peary ever made. He reached winter quarters on July 26, soon after break-up, and sailed south in the *Roosevelt*.[8]

In 1908–9 Peary again wintered the *Roosevelt* near Floeberg Beach. The winter was employed by the Eskimos as before in hunting musk-oxen and caribou for dog food from temporary camps as far afield as Fort Conger. In February parties started transporting stores to Cape Columbia, where a large cache was to be built up for the attempt on the North Pole. Full and careful preparations and five supporting parties led to Peary's final achievement, the fruit of twenty-five years travelling in the far north. The *Roosevelt* sailed south in August 1909.[9]

No more parties travelled along the north coast of Ellesmere Island until the 3rd Thule Expedition in the spring of 1920. The Dane, Godfred Hansen, on a long sledge journey from Thule with Eskimo dog-drivers, laid depots at Fort Conger, Depot Point and Cape Columbia in support of Roald Amundsen's north polar drift in the *Maud*. The expedition followed the coastal route from Fort Conger to Cape Columbia, which was reached on April 20. The depots were never used by the *Maud* expedition, for the *Maud*, after passing three winters along the north coast of Siberia, did not continue her eastward drift across the Polar Basin.[10]

In 1930 Kruger, leader of the lost German Arctic Expedition, and his two companions, Bjare and the Eskimo Ahqioq, travelled north from Greenland via Bay Fiord and Nansen Sound. In late April they visited Lands Lokk, before heading towards the south-west, and the unknown fate which overtook them.[11]

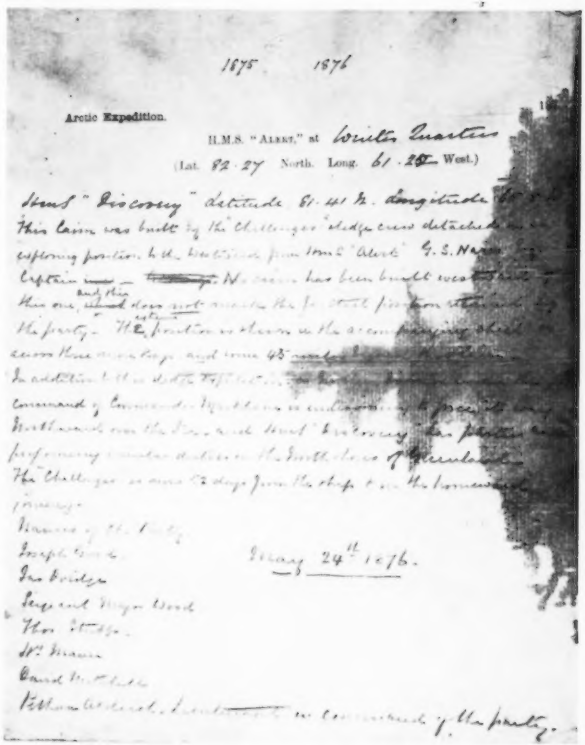
In 1935 the Oxford University Ellesmere Land Expedition, based on Etah, sent




*Northern Ellesmere Island, showing routes of the 1953 and 1954 expeditions*

Royal Canadian Air Force

*Milne Bay looking east, with main glacier (centre) merging with ice shelf*



1875 1876

Arctic Expedition.

H.M.S. "Alert," at winter Quarters

(Lat. 82 · 27 North. Long. 61 · 25 West.)

*Aldrich's record from Cape Fanshawe Martin, recovered on 4 June 1954*

one party via Fort Conger and Lake Hazen into the mountains of northern Ellesmere Island. Moore and the Eskimo Nookapingwa reached a height of 9000 feet, whence they had a view of the unknown land as far as the ice of the Polar Sea at Clements Markham Inlet on the north coast. They remain the only party to have reached the inland ice to the west of the line of Clements Markham Inlet.[12, 13]

The Danish Thule and Ellesmere Island Expedition of 1939–41, under the leadership of James van Hauen, visited the Lake Hazen region,[14] but to the north there were no further travellers until after the war and the opening up of the Arctic by the aeroplane.

In 1948 a United States Naval Task Force, which included the icebreakers U.S.S. *Edisto* and U.S.C.G.C. *Eastwind*, reconnoitred the north-east coast of Ellesmere Island as far west as Cape Belknap, where a cache was laid. In 1950 the weather station Alert, was established.

From Alert in 1951 biological work was undertaken by Mr. P. F. Bruggemann [15] and Mr. S. D. MacDonald.[16] Their work lay mainly near the station, but they made a trip up Wood River nearly to the ice cap. In 1952 a geographical survey was carried out by Mr. P. Gadbois and Mr. C. Laverdière, who worked within a 10–15 mile radius of the weather station.[17]

In 1946, on a reconnaissance flight, the United States Air Force sighted T1, the first of the floating ice islands of the Polar Sea to be discovered. By the end of 1950 the U.S.A.F. had discovered T2 and T3, two more of these huge ice masses with the unusual, ribbed surface pattern. T2, the largest of the three, had an area of about 300 square miles. Subsequent study of air photographs showed that all or most of the ice islands almost certainly originated on the north coast of Ellesmere Island, where the ice shelf shows the same unusual surface pattern. The air photographs also revealed a number of smaller ice islands in the channels of the Canadian Archipelago.[18] The United States Air Force made a first landing on T3 in March 1952. Flying from T3 in May of that year, Lieut.-Colonel (now Colonel) J. O. Fletcher, with Lieut.-Colonel W. P. Benedict and Mr. A. P. Crary, landed for a short time at Cape Aldrich to examine the Peary monument, set up there in 1909, and the Hansen cache.* [19, 20, 21] From March 1952 until May 1954 the United States Air Force maintained a weather station on T3, and supported a comprehensive programme of scientific research in oceanography, hydrography, glaciology and geophysics.† [22, 23, 24]

The Defence Research Board was anxious to follow up this work on T3 with similar work on the north coast of Ellesmere Island, the region of the probable parent ice mass. A reconnaissance of the region was planned for 1953 to pave the way for detailed work on the ice shelf in 1954. The Geological Survey of Canada was interested in obtaining reconnaissance data from an almost unknown region, and their officers—Dr. Robert G. Blackadar in 1953, and Mr. Robert L. Christie in 1954—not only made valuable contributions in their own field, but were also extremely helpful in other fields of study. As stated earlier in this paper, the 1953 expedition was a joint Defence Research Board and Geological Survey venture.

Geophysical and glaciological studies on T3 were respectively under the direction of the United States Air Force Cambridge Research Center and the Snow Ice and Permafrost Research Establishment, Corps of Engineers, United States

* The Danes referred to this as the Cape Columbia Depot.

† A small United States party, under the leadership of Mr. A. P. Crary, reoccupied the station from April to September 1955.

Army. These two organizations were able to join with the Defence Research Board and the Geological Survey in the 1954 expedition. Mr. Albert P. Crary (geophysicist from A.F.C.R.C.) and Mr. Ernest W. Marshall (glaciologist from S.I.P.R.E.), who had between them spent a total of more than twenty months on T3, were thus able to extend their studies to the Ellesmere ice shelf. The work in both years was made possible through the excellent logistic support of the United States Air Force Military Air Transport Service and North East Air Command. Through the courtesy of the Danish authorities it was possible to enlist the help of two Greenlanders from Thule, who served as dog-drivers for the first two months of each season. They were, in 1953, Rasmus Majak and Sigssuk, and, in 1954, Imina and Karkutirak. Reports on the geological and glaciological work in 1953 have already appeared [25, 26]; a general account of the two expeditions, with the 1954 preliminary scientific results has also been published.[27]

## The 1953 Expedition

In 1953 Blackadar and I had the good fortune to be the first land party for thirty-three years to travel along the north coast of Ellesmere Island, and to follow the route of the earlier travellers to Cape Columbia. By comparison, of course, our travelling was very easy, for it did not begin until a C.54 aircraft of North East Air Command, U.S.A.F., had safely landed us on the airstrip at Alert weather station. From Alert, with the help of the Greenlanders Rasmus Majak and Sigssuk, we used the traditional method of travel in a region where dog-teams still provide the best and most economical means of making detailed ground surveys. Ideally air-drops should be used to support the dog teams, but unfortunately this was not possible with us.

We landed at Alert on April 21, but it was not until the 29th that we were ready to leave for the trip westward along the coast to the ice shelf. The rough pack and deep, soft snow between Alert and Cape Joseph Henry prevented us from carrying more than about 500 lbs. on each *komatik*; so we resorted to relaying, which continued as far as Point Moss, by which time our loads were lighter and the going was altogether smoother with less soft snow. On Crozier Island we visited the cairn built by Aldrich on the summit, but could find no record. We assumed that Peary had secured it in 1902 or later, but it will be seen below that we were wrong.

The afternoon of May 11 saw us off Wood Point, the *komatiks* gliding easily over the smooth bay ice, for the most part windswept clear of snow. Our trail lay behind us towards Giffard Peak, and away to the south-west, clear cut against the blue sky of that brilliant day, rose the mountains of the British Empire Range. Ahead, for some time, we had been able to see Peary's cairn on the northern summit of Cooper Key Mountain; then we were able to make out the Peary signpost, on the knoll above "the low last edge"—the gravel spit of Cape Aldrich. The last stretch to Cape Aldrich took us across the remnant of ice shelf, which lies in the outer part of Parr Bay, protected by the gravel spit. And so we made camp not far below the Peary signpost. After securing the dogs, we did not wait to pitch the tents, but went straight up to the signpost. The upper part was broken off, and the board with Cape Columbia inscribed and the arm pointing to the North Pole were hanging down. The arms were still stayed by the wires in Peary's photograph.[9] Lashed to the post were the ski and ski-pole, left in 1952 by Lieut.-Colonel J. O. Fletcher, U.S.A.F., and Mr. A. P. Crary, when they landed here on a flight from the ice

island T3. An earthenware jar was standing at the foot of the cairn. Although the lid was tightly clamped down, the rubber washer had perished, water had entered the jar, and the paper inside was reduced to pulp. Two hundred yards west of the signpost, we could see the *komatik* runners marking Hansen's cache, half buried in the snow. Hurrying towards it, we saw through the snow the top of a tin can, which might have contained rum but which proved to hold nothing more palatable than paraffin for the primus stove near by. There were also two cases of provisions, put up by Beauvais of Copenhagen, with about half the food in good condition; a very fine shotgun-rifle in a tin box with cartridges and shells; a crow-bar; and most interesting of all, a small tin box, containing Godfred Hansen's records, the plans for the depot journey to Cape Columbia (signed Knud Rasmussen), and some mail, all addressed to Captain Roald Amundsen. All these papers were carefully wrapped in oiled silk, and were in as perfect condition as on the day they were left.[10] With the papers were two pairs of snow goggles made by Cornelius Knudsen of Copenhagen. When looking over our finds later in the tent, we discovered that none of them pleased Rasmus Majak so much as the broad steel *komatik* runners, standing above the cache; the following afternoon he spent fixing them to his *komatik* to speed us on our return trip through the deep soft snow east of Point Moss.

We were late to our sleeping-bags that first night at Cape Aldrich, and not out of them until 8.30 the next morning. After mending the signpost, Blackadar and I went down to the ice shelf in Parr Bay, and lined up ablation poles over a distance of 2 miles out from the spit and roughly parallel to the shore. We fixed these with reference to points on the land, and we also made marks on the poles at the present snow and ice levels. The next day we planned to go up to Peary's *suggermuktuk* on the northern summit of Cooper Key Mountain. The Greenlanders were just as keen as we to visit the cairn, and had long decided it was the main objective of our trip. Who could blame them in thinking this? We had so far seen no game, and, but for the traces of "Pearyaksuak," Hansen and Fletcher before us, it would have been for them a trip of singular pointlessness. A three-hour climb up the shoulder of the mountain brought us to Peary's massive cairn on the summit, which was in cloud and swept by a 40-knot wind. From a crevice in the upper blocks of brown-weathered gneiss, I pulled out Peary's rusty cocoa tin. The lid came off easily and inside were a piece of his North Polar flag and a short note dated 8 June 1906, when he was outward bound on his great western journey to Axel Heiberg Island.[8] Blackadar copied the record with numb fingers; then, with no view from the top to detain us, we hurried back to camp.

The next day Blackadar was able to extend his geological observations on the Cape Columbia gneisses to Markham Bay, which we reached via the icefoot—an easy highway for a dog sledge inside the confusion of the polar pack. I set up a line of ablation poles across the bay. Our one bad blizzard of the summer kept us in camp the following day; the wind was gusting at times to 50 knots and carrying heavy drift. We left for Alert on May 16 and, picking up dog food cached on the outward trip, reached the station in four days. A detour of 5 miles up Clements Markham Inlet gave Blackadar an opportunity to examine the metamorphic rocks on the west side and the shales and shaley limestones on the east side of this deep fjord. When we got back to Alert, it became clear that the thoughts of the Greenlanders were turning to Thule and walrus; they wanted to return before the end of June for the summer hunt, but we planned one more trip with them.

On May 28 we left Alert again for the west, following the same route as before,

except that this time we followed the icefoot round Cape Hecla, instead of crossing Parry Peninsula via Sail Harbour, as on the previous trip. We made our final camp in the small bay just west of Point Moss, where we spent three days. While Blackadar studied the local geology, I worked on the small remnant of ice shelf in this bay. On the return trip we killed a small seal on the ice of Clements Markham Inlet, whose emaciated state gave the Greenlanders a very poor impression of "Canadian seals." However, it provided us with an extra day's dog food and enabled us to travel 15 miles up Clements Markham Inlet. From camp at Crozier Island on June 7, I found that all the snow had disappeared from Aldrich's cairn; at the foot lay a rusty cylinder containing, somewhat damaged, his record of 17 April 1876.[3] It is remarkable that Peary had not recovered this record, for he and his parties must have camped on or near Crozier Island on many occasions.

After our return to Alert we made a three-day trip to the Cape Sheridan region and Floeberg Beach, where the polar ice presses hard on a shore marked by piles of barrel hoops and rusty tins from the Nares and Peary expeditions. In the words of Knud Rasmussen, "looking out over this great expanse of close-packed, coarse polar ice . . . one cannot but feel the greatest admiration for that old English seaman who . . . found way for a ship so near to the pole." There are cairns or monuments above Floeberg Beach commemorating the "British Arctic Expedition" (1875–6), Niels Christian Peterson (d. 1876), the *Roosevelt* (1905–6) (two cairns), Ross G. Marvin (d. 1909), and the United States Navy and Coast Guard (1950).

For the last fortnight of June we were daily expecting a plane to fly out the Greenlanders. But it was not until July 3 that Blackadar and I were able to leave for Wood River on a back-packing trip, having seen the Greenlanders safely on their way back to Thule. The walk up Wood River, the visit to the glaciers of the United States Range, and the ascent of Mount Grant in the warm summer days were in pleasant contrast to our travels in May along the coast, still in winter's grip. We enjoyed temperatures up to 55° F., the Arctic plants in full flower, and glimpses of grazing musk-oxen. At our furthest point, beneath the 100-foot ice cliff of the huge glacier lobe, first seen by Lockwood and Brainard, we were within 30 miles of Lake Hazen to the south-west. Near the foot of this cliff we found Miocene or later deposits with coal, wood, and a fossil fir cone, since identified as belonging to *Larix* or *Picea*. The present vegetation right up to the ice cliff shows that there has been no glacial retreat in the last few decades. We returned down Wood River on July 12 in overcast weather after the long fine spell. Before returning to Alert we made a four-day trip westward to the 2000–3000-foot hills behind James Ross Bay, where Blackadar was able to extend his observations on the Feilden Peninsula group of Permo-Carboniferous limestones and sandstones, now completely snow-free. His studies point to a period of orogenic movement in Permo-Carboniferous times. Coming back, we walked round the shore of Black Cliffs Bay, where before we had crossed the ice, and arrived back at Alert on July 21.

An attempt to reach Fort Conger across the hills south-east of Alert was foiled by bad weather and low visibility. We contented ourselves with retrieving relics from an old camp of the *Alert* expedition, 10 miles south of Cape Sheridan, which was established by Giffard and Conybeare on 7 July 1876.[28] Later in England I had the pleasure of describing this incident to Mrs. Crawford Conybeare, the widow of Admiral Conybeare. Twilight had not yet marked the close of the long summer day, but the first snow of autumn already covered the ground, when on August 16 we left Alert by air for Thule and the south.

## The 1954 Expedition

"A squadron of aeroplanes . . . could alight on the firm level 'glacial fringe' at Cape Columbia, unload their supplies . . . and be back at their base in less than a day." Peary wrote these words in 1917 [29]; perhaps he would have approved of our ice shelf operations in 1954. We landed on April 24 in two C.47 aircraft of North East Air Command, and set up camp on the ice shelf 3 miles west of Ward Hunt Island. The temperature was a little above zero. Four further loads of food and equipment had been brought in by May 14. Meanwhile two short trips were made by dog-team. On the first of these, Marshall, Christie and I visited the Cape Albert Edward region. Christie reconnoitred the geology, while Marshall and I made snow depth and density measurements on the glacier behind camp to a height of 1500 feet. On May 2 Christie and I left the main camp for the Cape Columbia region, where last year's reconnaissance had ended. We made camp that night in Markham Bay. The following day, while Christie went about 7 miles up the bay with Karkutirak to do geology, with Imina's help I looked for the ablation poles set up last year. Only one was still standing, but this showed a surface increment of 3 inches of refrozen melt water. Theodolite observations showed no perceptible movement of the ice shelf since 1953. The same evening we left for Cape Aldrich, and about 9 p.m. made camp there on the ice foot below the 40-foot rampart of the polar pack, not far from the Peary signpost.

Next day we recovered Hansen's copy of MacMillan's 1908 note in the tide gauge, 3 miles south of Cape Aldrich, at "Crane City," Peary's advance camp for the polar journey of 1909, which Blackadar and I had not visited in 1953. While Christie and Imina visited Wood Point for geology, I looked in vain for my poles set up in 1953 on the ice shelf of the bay. They had presumably all fallen down due to the 1953 ablation; it was unfortunate that they had not been fixed more deeply. Observations the following day showed that the 80-foot ice cliff close to camp had moved forward a distance of 20 feet since 1953. A day and a half of travel brought us back to the main camp on May 7. By this time Crary and Marshall had cored a 70-foot hole in the ice shelf at camp, in which thermocouples were installed, and had started survey work on the shelf. It was now decided that Crary and Christie should travel down Disraeli Bay with Imina, while Marshall set up camp near the shelf edge to the north to do ice coring. Crary and Christie left for Disraeli Bay on May 9, but returned the same evening, after encountering very heavy snow in the mouth of the bay; it was difficult to travel even on skis and the dogs were wallowing in 4 feet of snow. The steep sides of the troughs in the bay further increased the difficulty of the travel.

Christie and I could not now long delay our projected trip to the west. The Greenlanders had by this time decided that they wished to return to Thule on the first available plane, but Karkutirak generously agreed to leave us ten of his twelve dogs and Imina four of his. It was our plan on this journey to travel as fast as possible for the first nine or ten days, in the hope of reaching Lands Lokk. We would then be able to spend a day at our "farthest west" and allow thirteen or fourteen days for the return trip, which would include detours into the fjords for geology. Christie and I left camp with Karkutirak's ten dogs on May 14, and, travelling 20–25 miles a day, we were able to reach the entrance of Nansen Sound on May 22, and Lands Lokk on a long walk the next day. It will be seen from the map that for most of the outward trip we were usually several miles from the nearest land. West of Cape Bourne and throughout the return trip, however, Christie was able to do

geology all day, meeting me at an agreed camp site in the evening. We left our westernmost camp on May 24 and arrived back at the main camp on June 6, the twenty-fourth day, well satisfied with the trip within the limits of the time at our disposal. Christie had completed the geological reconnaissance of the north coast of Ellesmere Island. Intense folding of the rocks and intrusions of granitic, basic, and ultrabasic rocks lend support to the hypothesis that the region is the core of the orogenic system, to which the name "Innuitian" has been given.[30] From the remnant of the ice shelf near Alert Point I was able to collect two 10-foot ice cores for petrological examination by Marshall, and was able to obtain a close look at the glaciers which reach the coast in the Yelverton Bay region. South of Alert Point a large glacier has advanced across a presumed marine terrace at 200 feet, probably since the last major glaciation. The 200-foot ice fall has not notably receded in the last few decades.

For historical reasons this was a most interesting trip, since we were only the third party to travel this coast as far as Alert Point, and only the second party to travel the coast west of Alert Point. From Cape Fanshawe Martin we recovered Aldrich's record and chart, left on the first ice-free cape on his return journey from Alert Point.[3] The snow of nearly four score winters "have melted into spring," but the massive British cairn stands as a reminder of the dauntless spirit of its builders, who added more than 200 miles of coastline to the map. Peary's cairn at Cape Colgate contained his record of 5 July 1906, the year in which, caught by the thaw, he was hard pressed to return to Cape Sheridan.[8] A few miles south-west of Cape Colgate, in a cairn originally built by Peary, we made perhaps our most poignant find, a record of Kruger. Unfortunately it added nothing new to our knowledge of his expedition, since it predated by two days his record found by Stallworthy at Cape Stallworthy on the search expedition of 1932.[11]

On returning to the main camp, we found to our surprise that the Greenlanders had not yet left for Thule, since the planes of May 14, bound for T3, had not been able to take them. Daily they had been watching for another plane. Under the circumstances only restricted use of the Greenlanders and their dogs had been made in our absence. But Crary had been making tidal observations and continuing the survey work, which included carrying a level across the 12-mile width of the ice shelf; he had also managed to take the oceanographic equipment to the edge of the ice shelf and take a station. Marshall had been continuing his ice petrological work. By the time of our return the thaw was evidently not far away, and the surface was becoming unfavourable for a plane landing. Therefore on June 15 the Greenlanders left by dog-team for Alert. The same day Crary and I left for the edge of the ice shelf, and during the next week took oceanographic stations as far west as M'Clintock Bay. On June 24 we returned to the main camp and gathered together the "paradrop" of our remaining stores, made the day before. We also learned that Marshall and Christie had left with Imina's four dogs and a small *pulka* to travel up M'Clintock Bay.

Crary and I returned to the edge of the shelf on June 25, and in the next six days obtained oceanographic stations as far east as Markham Bay. We returned to the main camp on July 1. Altogether we had occupied nineteen stations between M'Clintock Bay and Markham Bay, a distance of about 60 miles. Depths varied from 200 feet to no bottom at 1000 feet. Water samples and temperatures at various depths were obtained at three of these stations. On July 4 Christie and Marshall returned from M'Clintock Bay, after a hard trip due to the rapid onset of the thaw. The troughs were now lakes, and the snow on the ridges slushy.

*Final camp on "ice rise" with Ward Hunt Island in background. 5 September 1954*

*Geological Survey of Canada*

*Karkutirak standing beside Hansen's cache at Cape Aldrich, 5 May 1954*

Royal Canadian Navy

*Relics from camp established by Giffard and Conybeare on 7 July 1876*

Royal Canadian Air Force

*"Mainland" of northern Ellesmere Island south of Ward Hunt Island. 19 April 1954*

During July and August travel on the ice shelf with dogs was severely restricted by the trough lakes which had now formed to a depth of 3 feet or more, and by the sharpness of the ice crystals of the weathered surface of the ridges. The 1954 thaw season seems to have been unusually prolonged; 24 inches of ice were lost from the surface at the main camp. During these months two or more of the party were on Ward Hunt Island or on the "mainland," leaving always at least one at the main camp. Three trips had to be made by a devious route, avoiding trough lakes as far as possible, to the edge of the shelf to make radio contact, since we had not been able to bring back the radio before the thaw set in. On the "mainland" Christie extended his geological investigations, and I was able to visit two glaciers of the corrie type. Marshall investigated the ice shelf around Ward Hunt Island and in the outer part of Disraeli Bay. Crary carried out seismic work along the ridge from the main camp west towards Cape Discovery. Plant collections were also made on Ward Hunt Island and on the "mainland."

By the middle of August everyone was back at the main camp. Marshall now decided to start coring on the "ice rise" * on the west side of Ward Hunt Island, so he and Christie moved camp there. About this time Marshall found a food cache and *komatik* laid by MacMillan for Peary on the north side of Ward Hunt Island in 1909.[31] We were now eagerly awaiting the freeze-up so that dog travel would again be easy, but it was not until September 2 that Crary and I could leave the main camp for Cape Discovery to complete the seismic traverse. Along this line a deep submarine canyon was found with a maximum depth of about 2600 feet. The ice shelf had a maximum thickness of 160 feet.

By first sunset on September 6 the freeze-up had truly begun; the following day we left camp for Markham Bay with all the dogs, Imina's four pulling the MacMillan *komatik*. That evening we made camp near Cape Nares, and in the next two days Crary, by seismic methods, obtained depths in Markham Bay and a thickness of 25 feet for the ice in the re-entrant of the ice shelf. Marshall collected ice cores down Markham Bay, and Christie investigated the geology. After our return to the main camp on September 10, we finished moving all stores and equipment up to the "ice rise," which was clearly going to provide the best surface for the landing of a plane. On September 14 Crary and I drove down to the edge of the shelf to fetch equipment remaining there, and to allow Crary to reoccupy an oceanographic station of June, in order to assess change in temperature and salinity after the summer. In the next few days coring on the ice shelf near a camp site of a Peary party and on the "ice rise" yielded two 60-foot cores to take back to the cold laboratory in the United States for detailed study. Crary and Christie made a final trip 10 miles up Disraeli Bay to obtain oceanographic data, and for geology. Sounding inside this fjord showed no bottom at 1000 feet.

The C.47 relief plane piloted by Colonel W. L. Kimball, commander of Thule Air Base, arrived on September 19 and Christie went out with the dogs and the first load of equipment. It was not until September 26, after a spell of bad weather, that the rest of us followed in another C.47. We spent that night at Alert Weather Station and arrived in Thule the next day. The season ended pleasantly with a trip to the new Thule village at Kanak on the north side of Inglefield Bay in the United States Navy icebreaker *Staten Island*. Our dogs were then able to travel home in state, and we were able to see the Greenlanders in their new homes—Odaq, the

* Defined as "a mass of ice resting on rock and surrounded partly by an ice shelf and partly by sea." [31] In this case it is surrounded partly by the ice shelf and partly by the ice-free part of Ward Hunt Island.

last survivor of Peary's North Polar party (who died in May 1955); Inuterssuak, who was with the Oxford University Ellesmere Land Expedition; and our own Karkutirak.

*Note on the map facing page* 14: The latitude and longitude of the sketch-map have not been adjusted in accordance with sun-shots taken in 1954, as the extent of the coastline affected is not known. The 1954 sun-shots, taken from the main camp (lat. 83° 06½′ N., long. 74° 44′ W.) indicated that Ward Hunt Island and the nearby coast of Ellesmere Island are approximately 6 miles to the east of the position given on the sketch-map.

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## DISCUSSION

*Evening Meeting, 6 June 1955*

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: Mr. Hattersley-Smith in 1953 and 1954 worked for the Canadian Defence Research Board in Ellesmere Island to the west of Greenland, or off the northern part of Greenland on the Canadian side. There has been a great deal of interest in the ice shelf of Ellesmere Island, due to the discovery of several large ice islands in the Arctic Ocean floating round in a clockwise direction. Three of them were observed some years ago by the United States Air Force and the Royal Canadian Air Force, and rather unimaginatively named T1, T2 and T3. But Mr. Hattersley-Smith will no doubt tell us something about them, and about other features of the Canadian Defence Research Board's work in this remote country.

*Mr. Hattersley-Smith then delivered his lecture.*

The PRESIDENT: Our lecturer has shown us what the world looks like in these remote regions. This Society is particularly interested in Arctic exploration. Perhaps it is a comment on modern human "progress" that such exploration was undertaken in earlier times in the spirit of adventure and scientific discovery, and now it has to be carried on for reasons of defence and security. We have with us tonight Brigadier Morrison, the London representative of the Canadian Defence Research Board, and I will ask him to say a few words to us.

Brigadier G. P. MORRISON: You will have noticed from the names on the map and the history of the various explorations in the past that Canada itself in this field of exploration does not stand very high. Most of this work has been done by people from the United Kingdom, and some by our neighbours in the United States. One reason for this is, of course, that in the past we have lacked the wealth and I might say the culture to get the type of men required for this form of exploration. But the Canadian Defence Research Board has set up in Churchill a laboratory the purpose of which is to study the conditions in these regions, so as to enable the soldier, the airman, and the sailor to operate in the Arctic. There is a terrific amount of work to be done, and I think you will have gathered from the lecture something of the nature of the task, in its technological aspects, that awaits us. For one thing, I do not think we have got the type of vehicle as yet which will give good service in the Arctic. We have also to consider the problem how to make the equipment operate under conditions of extreme temperature. We are hoping, with the help of universities and of departments of Government, to make good deficiencies in our knowledge, in order to make it possible, if necessary, for men to live in these regions. I cannot go into details, but

those who have tried to operate cameras in the part of the globe which has been the subject of the lecture tonight will appreciate the high quality of the slides that have been shown us.

Professor FRANK DEBENHAM: I have always thought that life at the Poles was life in a desolate ice environment, but I now realize I was wrong, for we have seen tonight pictures not only of beautiful ice formations, but of flowers and charming Eskimos. We have even had a picture of man pulling dog, which was distinctly news. And we have heard a modest account of some good work which I am certain has great scientific value. I think myself that these "ice islands" off the coastal fringe are a unique kind of ice. Here they are 12 or 15 miles long and 4 or 5 miles broad and they have been floating around for four or five years or more, and apparently could go on floating indefinitely. It is an intriguing problem in ice formation which I cannot fully explain. May I join with other speakers in thanking the lecturer

Wing Commander SHACKLETON: I should like to correct one point in the discussion, that the Canadians have done so little in Arctic exploration. The Royal Canadian Mounted Police have a great record and the work they have done has not been as fully recognized as it should have been. Turning to basic scientific problems, these ice islands are certainly one of the most engaging. Previously we were told that these floes of ice drifted about and were re-frozen year after year; now we understand that they break off from the northern ice shelf, and I wonder how far they drift. I should like to ask a question as to the permanence of the ice cap on the mountains, its thickness, and so on. That was one of the aims of the Oxford University expedition to Ellesmere Island led by Dr. Humphreys. Incidentally, it took him three weeks to get to northern Ellesmere Island, whereas I suppose it takes only an hour and a half in a Dakota. One other remark the newspapers a few weeks ago mentioned the death of Odaq, one of the most notable men living in these Arctic regions.

Mr. G. HATTERSLEY-SMITH: On the point raised by Professor Debenham on these peculiar ice formations I can say that they do not originate from glaciers which have moved off the land. As for the topography of the mountain region the mountains stick up through what is probably a relatively thin ice cap. Mention has been made of Odaq the Eskimo, who died three weeks ago. He was aged about eighty and was the last of the four Eskimo with Peary on the final stage of the North Pole journey in 1909. I had a picture of him on the film I showed, but I am afraid I cut it owing to lack of time. Reverting again to this question of the floating ice islands, there are reports which probably bear on the subject by voyagers as early as the seventeenth century. To come nearer to our own times, they were mentioned by Dr. F. A. Cook, who claimed to have reached the North Pole the year before Peary (1908). One of them is known to have been drifting round there at any rate for eight years, and probably will go on travelling for quite a while.

The PRESIDENT: There is an exhibition in an adjoining room of records of previous explorations which members of the audience may like to look at afterwards.

*Note received from* Dr. G. C. L. BERTRAM, *Director of the Scott Polar Research Institute, Cambridge*

"Sadly I am unable to be present this evening. Mr. Hattersley-Smith has achieved much in northern Ellesmere Island. He is a fine example, of which there are all too few, of the proper transition from the old style travel by men and dogs to the new transport of this aerial age. He makes the best use of both and, what is now so rare, he has the vigour and the common sense to go on using his own legs. That in these days is a notable achievement, and his discoveries worthily record his efforts."

# THOMAS MILNE'S LAND UTILIZATION MAP OF THE LONDON AREA IN 1800

G. B. G. BULL

TO MAKE A land utilization map of a piece of country, the modern geographer selects a base-map showing field boundaries. By inspection of the ground, he inserts a key letter within each field to show its use, such as A for arable land, M for meadowland, H for heathland, and so on. He then prepares a coloured map, with arable land in brown, meadowland in light green, forest in dark green, heathland in yellow, gardens in purple and agriculturally unproductive land in red. This procedure derives from the method adopted by the Land Utilization Survey of Britain to record the face of Britain in the years 1930–8. The use of letters and colours on the published land use maps of this Survey was not entirely new, however, for as early as 1800 Thomas Milne had prepared for publication a hand-coloured, engraved map of the London area which makes use of this technique.

Milne's map, on a scale of 2 inches to 1 mile, is engraved on six plates, each $11\frac{3}{4}$ by 15 inches. It bears the title "Milne's Plan of the Cities of London and Westminster, circumadjacent Towns and Parishes &c, laid down from a Trigonometrical Survey taken in the Years 1795–9. Printed for and Published by Thomas Milne, No. 7 New-street, Knightsbridge as the Act directs; 11th March 1800." An area of about 260 square miles, extending from Harrow Weald to Woodford and from Hampton-on-Thames to Sundridge Park is covered by the map. The map records the use of each field by means of an inserted letter and an overpainted colour. These make it possible to distinguish no less than twelve different types of land use; as several are sub-divided, seventeen categories in all may be distinguished.

Arable land, when enclosed, is shown by the italic letter "a" and a pale brown colour not unlike the one used by the Land Utilization Survey a century and a quarter later. Enclosed meadow and pasture are shown exactly as on the later Survey, by the letter "m" and light green colouring. Woodland is shown by the letter "w," tree symbols in the form of tiny circles, and dark green colour. Enclosed market gardens receive the letter "g" and light blue colour; nurseries "n" and orange colour. Orchards and osier-beds share the letter "o" and blue colouring, so that the map reader needs to judge from the nearness of the field to the river which of the two is intended. "Paddocks or little parks" are represented by the letter "p" and pink colour; the position of the residence within the park is shown by a black rectangle. Drained marshland pasture has the letters "ma" and grey-green colouring. Common fields, with their admixture of small strip-fields used for diverse purposes, present a difficult problem to the cartographer. One-third of the agricultural land of the London area still remained unenclosed in 1800. Milne showed great care and skill in representing, within the limits of scale, the variety of land use in common fields. The letters "caf" designate common arable fields. They are coloured brown if wholly arable, and bear conventionalized brown and green stripes if there is a considerable admixture of grassland strips with the arable. Common meadows bear the letters "cmf" and solid green colouring, or green and brown bands as might be appropriate. Common market-garden fields are shown by the letters "cgf" and blue colouring, or by blue and brown bands. Great care

is used to make information about common fields comprehensive. Within the common fields of Battersea, for example, it is possible to recognize on the map tracts of wholly arable land, blocks of meadow, areas of mixed arable and market-garden strips, a patch of drained marsh-pasture and a number of nurseries and market-gardens held in severalty within the boundaries of the common fields.

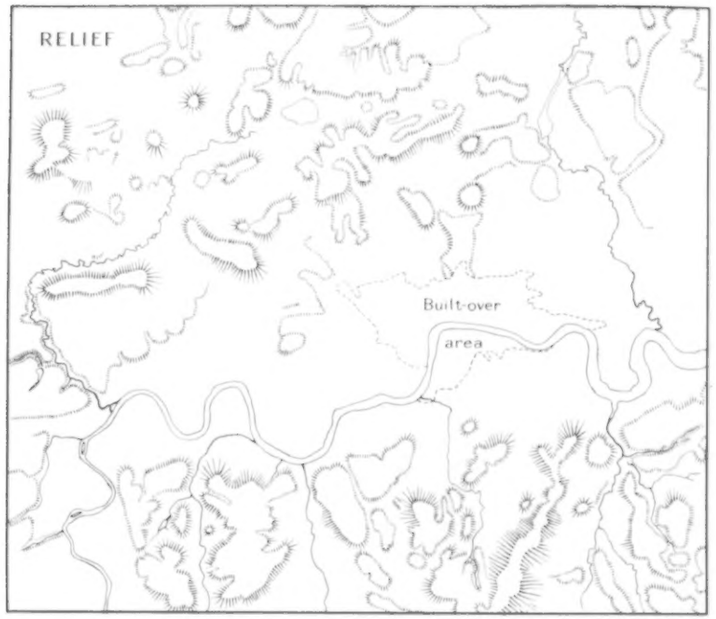
The legend attached to the map enables all forms of land use mentioned above to be distinguished. Other forms depend on the engraving for their recognition. Commons and open spaces such as village greens are shown without letter or colour, but have the name of the common, or green, inserted within the boundary. Lakes and flooded pits are shown, as on the modern six-inch Ordnance map, by thickening their outline on the north and west sides. The well-spaced buildings on the planned estates of Bloomsbury, Blackheath and Somers Town are stippled, whereas the congested streets in the older parts of London have their buildings densely ruled. In addition to roads, field tracks are shown by double lines of dots, with single dotted lines for paths across commons and open fields. Parish boundaries in open country are shown by dots in groups of three. Relief is shown by means of hachures assisted by a deepening of the colours over hachured portions which adds emphasis to them. The hachuring reveals clearly the erosion surfaces bevelling the summits of the ridges of Hampstead, Harrow and Richmond, and enables even subdued features such as the terminal bluff of the Taplow Terrace to be recognized. Milne's map is valuable as a means of visualizing the landscape of the London area in terms of a "physiographic staircase" of flats and slopes.

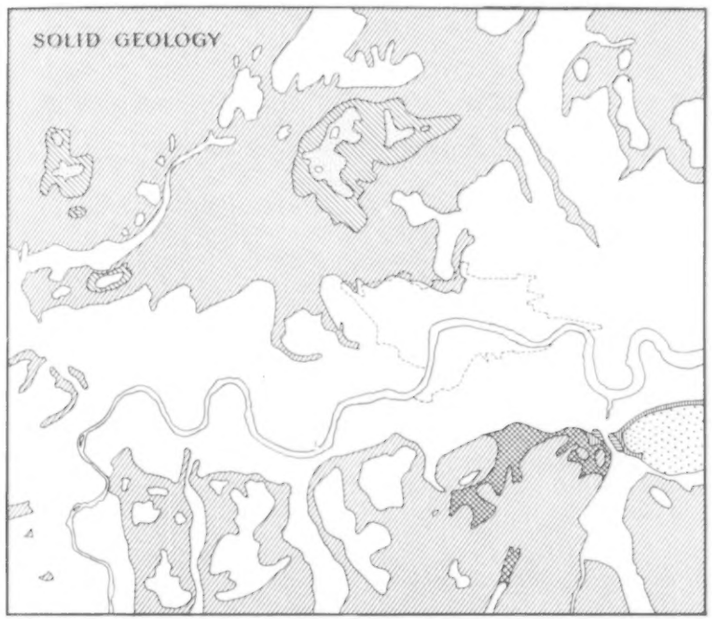
The map has been neglected because of its extreme rarity. Only one complete copy of the six sheets is known at present, and this is in King George III's Topographical Collection in the British Museum. The Crace Collection, also in the Museum, contains a copy of one sheet, coloured by parishes. It seems likely that a few copies were printed to secure copyright and for distribution to patrons, as each sheet bears Milne's signature and a serial number. If, after making these, Milne had been prevented by death, bankruptcy or legal injunction from issuing an edition for public sale, the scarcity of this map would be explained. It is the only known map to bear Milne's imprint as a publisher. William Faden, Cartographer to the King, was the publisher of two county maps, in which Milne and others were engaged as surveyors; these were of Hampshire and the Isle of Wight, surveyed in 1788–90, and Norfolk, surveyed in 1790–4. For Lord Frederick Campbell, Milne surveyed and engraved a plan of an earthwork at Hollwood in Kent. A trigonometrical survey of streets in Walworth dated 1794 survives in manuscript in the Crace Collection. Milne may be supposed to have had a considerable practice as a land surveyor both of estates and of larger areas. George Adams (the younger), in his 'Geometrical and Graphical Essays' (1791, 2nd edition 1797) calls Milne "one of the most able and expert surveyors of the present day," with special aptitude in the use of a light theodolite. Besides drawing for Adams' book all the plates of instruments, specimen surveys of estates, etc., Milne contributed to it chapters entitled "Mr. Milne's Method of Surveying" and "Observations on Plotting."

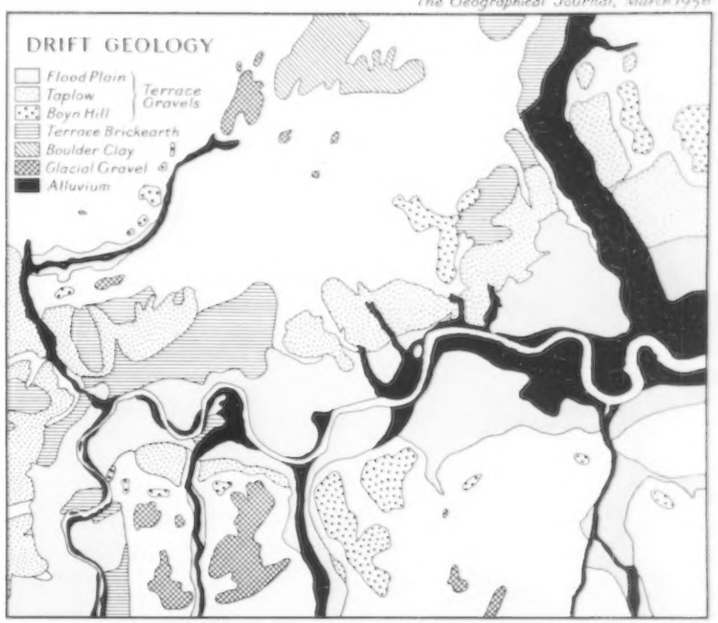
In the history of the representation of land use on English maps, Milne's map of the London area merits a very important place. By more than a century and a quarter, Milne anticipated the modern technique of using key letters and colours to record on small-scale maps the results of a field-by-field survey. He also appears to have been the first to make a complete record of the land use of those parts of Essex and Kent contiguous to London, for Chapman and André's map of Essex published in 1777 does not show field shapes and includes only a limited range of

# THOMAS MILNE'S LAND UTILIZATION MAP OF THE LONDON AREA IN 1800

*The Geographical Journal, March 1956*



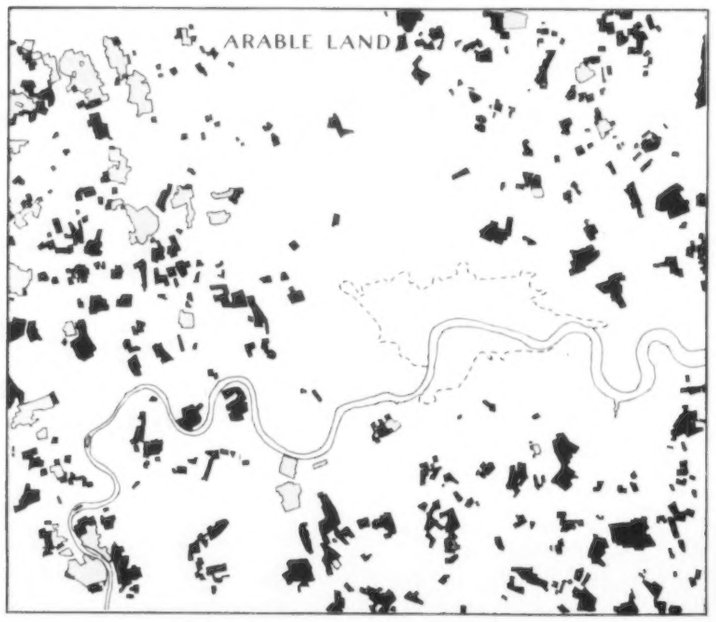



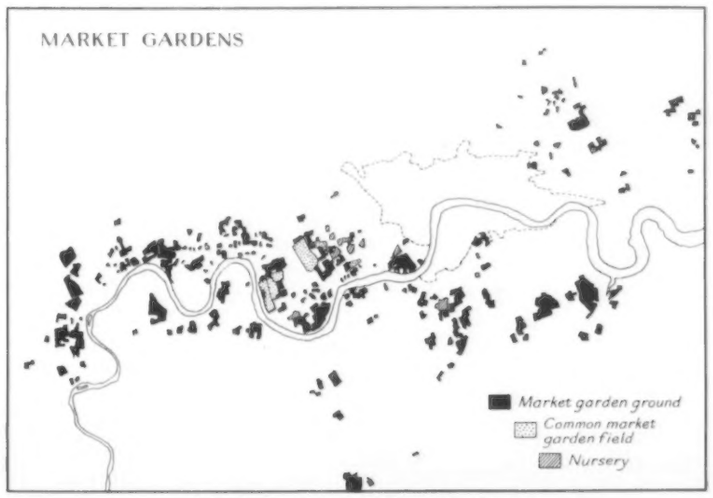

*Upper Chalk* *Thanet Sands* *Woolwich Beds* *Blackheath Beds*
*London Clay* *Claygate Beds* *Bagshot Beds*

Miles
1 0 1 2 3 4 5 6

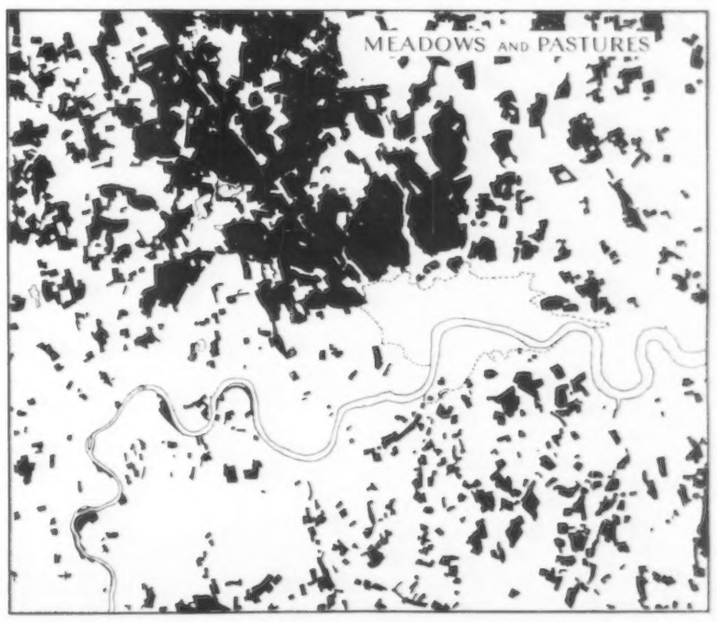
*Solid and Drift Geology are based on the 1 inch Geological Survey*




*Arable land* *Common arable field*

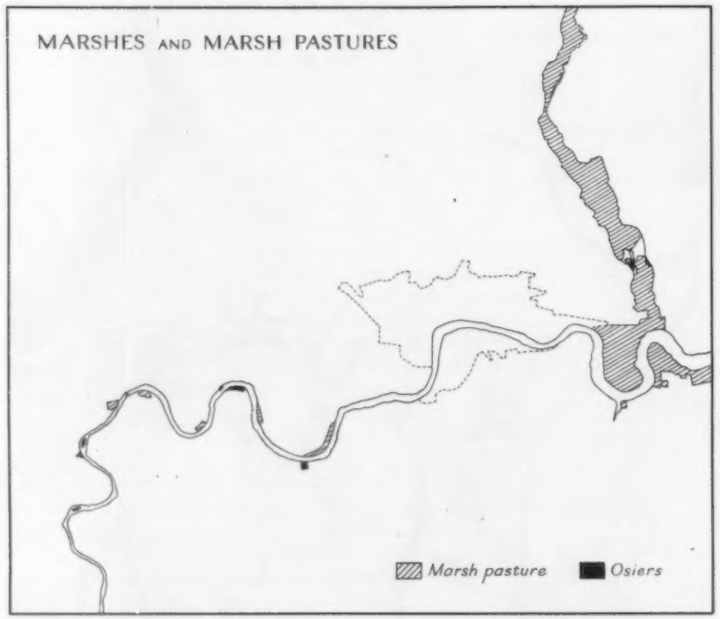


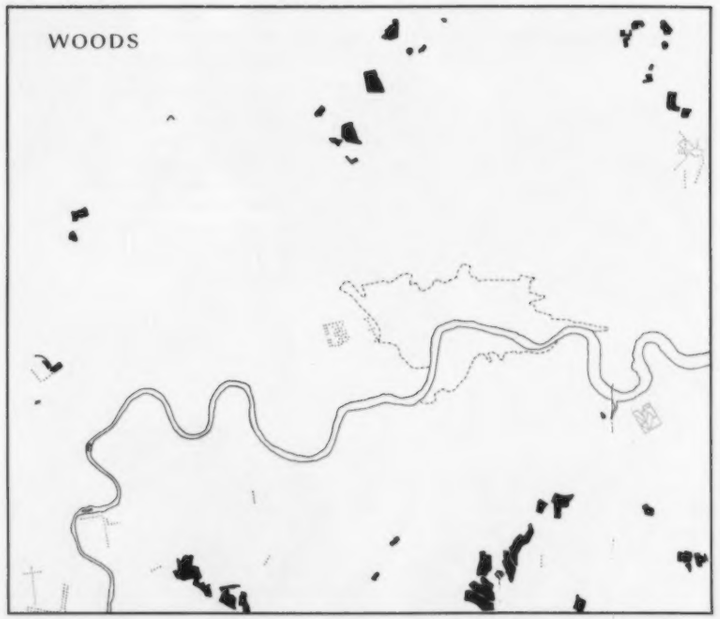

*Published by the Royal Geographical Society*

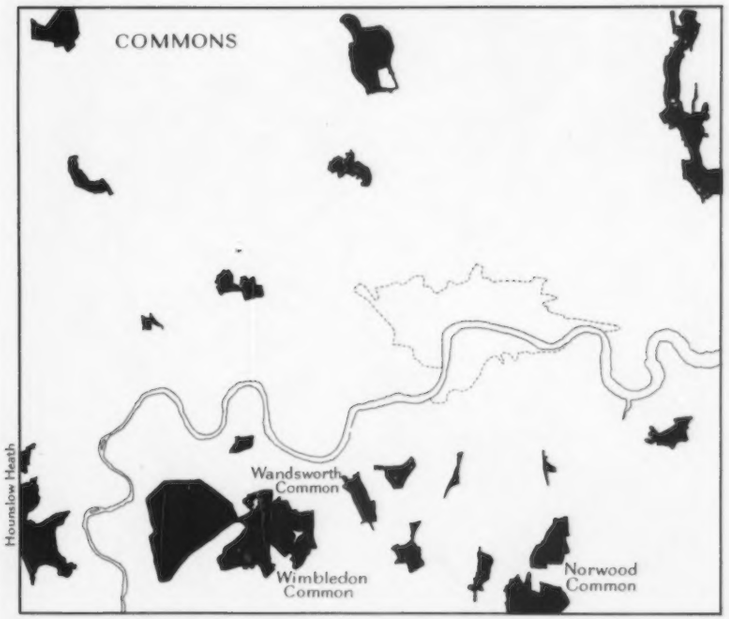


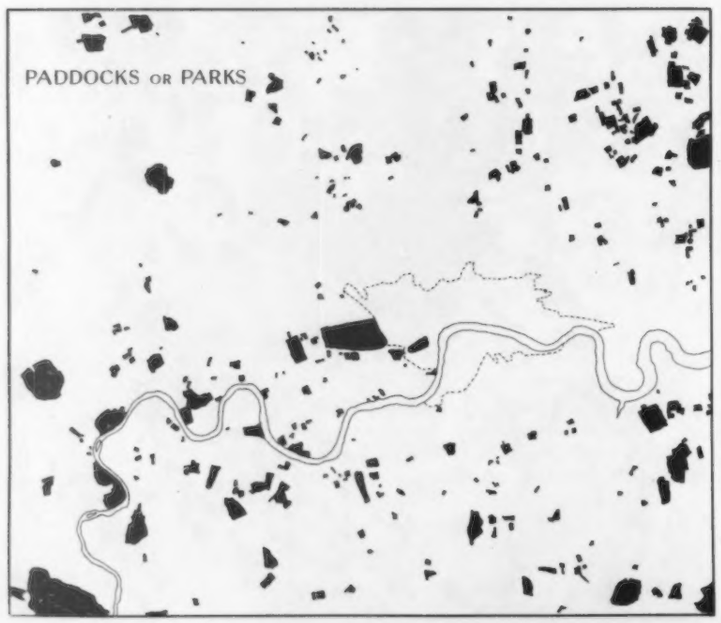

*Meadow and pasture* *Common meadow field*

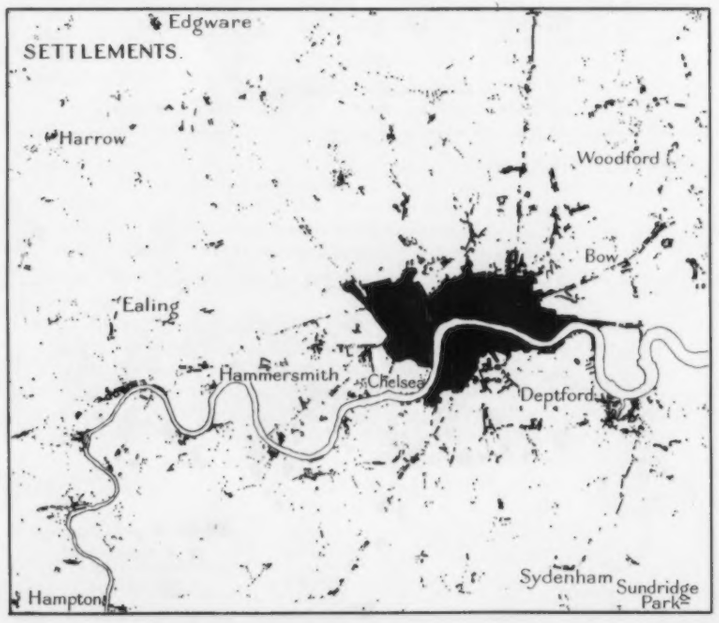
BULL

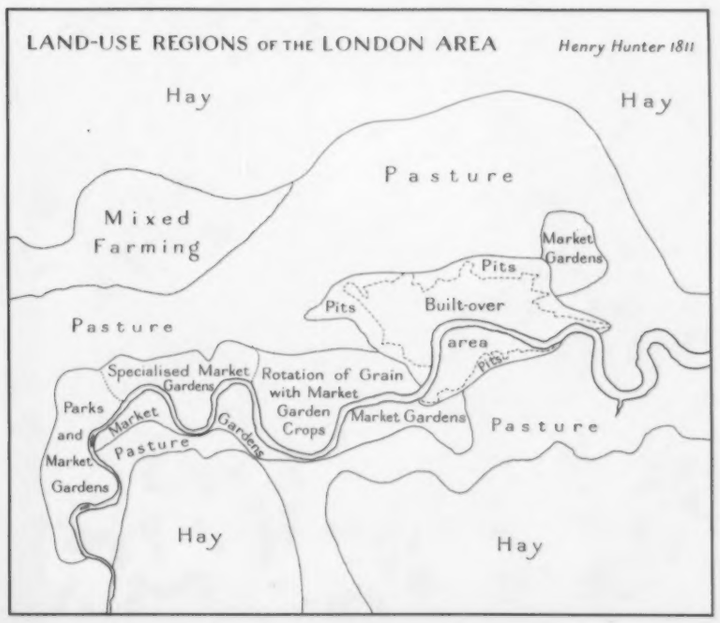

MARSHES AND MARSH PASTURES
Marsh pasture
Osiers


WOODS


COMMONS
Hounslow Heath
Wandsworth Common
Wimbledon Common
Norwood Common


PADDOCKS OR PARKS


SETTLEMENTS
Edgware
Harrow
Woodford
Bow
Ealing
Hammersmith
Chelsea
Deptford
Hampton
Sydenham
Sundridge Park


LAND-USE REGIONS OF THE LONDON AREA
Henry Hunter 1811
Hay
Hay
Pasture
Mixed Farming
Market Gardens
Pits
Pits
Built-over area
Pasture
Specialised Market Gardens
Rotation of Grain with Market Garden Crops
Market Gardens
Parks and Market Gardens
Market Gardens
Pasture
Pasture
Hay
Hay

forms of land use. Milne can be positively identified as using the primary and secondary triangulation, radiating from the Hounslow Heath base-line, carried out by General William Roy in 1788 for the specific purpose of "the Improvement of the Plan of London and its Environs." As an associate of William Faden, who published the first one-inch maps of the Trigonometrical Survey in the years after 1801, Milne probably had access to the observations made by the Survey's officers as well as to Roy's triangulation tables published posthumously in the Philosophical Transactions of the Royal Society for 1790 (Volume lxxx). Milne's representation of field shapes appears therefore to be based on the secure foundation of trigonometrical survey, so that his record of the areal distribution of types of land use has an accuracy hitherto unknown in small-scale maps of extensive areas.

Several cartographers of the generation before Milne's had shown certain types of land use on county maps by means of semi-pictorial symbols which depict ploughed land, gardens, herbage, heaths, paled parks and woodland, but their representation of shapes was diagrammatic. Foremost among them was John Rocque (*c.* 1705–62) whose map of the London area on a scale of 5 inches to 1 mile published in 1746 showed field boundaries in addition. The value of Rocque's maps is seriously reduced by the untrustworthy drawing of the shapes and sizes of fields, "his fields it is clear are merely conventional chequer work." [1] Rocque's technique of representing the surface of the land was derived from contemporary French practice and from his own experience as a "dessinateur de jardins," a delineator of landscaped parks and gardens. Following Rocque's example, several later maps of the environs of London recorded certain forms of land use by means of semi-pictorial symbols, to which colour was sometimes applied in an unsystematic way. The most detailed of them was R. Horwood's "Plan of the Cities of London and Westminster, the Borough of Southwark and parts adjoining, showing every House," on a scale of 25 inches to 1 mile, published in 1799. Detailed comparison shows Milne's map to be quite independent of earlier surveys. There is, however, a very close similarity between Milne's representation of field shapes and that appearing on the original Surveyors' Drawings, on a scale of 2 inches to 1 mile, from which the Trigonometrical Survey's first one-inch maps of the London area were engraved in 1807.

Milne's technique of differentially coloured and lettered enclosures had been commonly used on large-scale estate maps since the end of the sixteenth century. Letters were inserted to show the various owners of parcels of land, but not to show their use. Colours were often used to record the state of cultivation. John Blagrave's "Plan of the Forest and Manor of Feckenham, Worcestershire" of 1591, for example, used colours to distinguish between woodland, meadow, pasture and "corn ground" of the best, worst and moderate qualities.[2] As an estate surveyor for twenty years before becoming a cartographer, Milne would be familiar with conventions used on English estate maps almost unchanged from the Middle Ages onward. In producing a map of a larger area, he would not unnaturally incline towards an essentially cadastral mode of representation. In Milne's original map the colours give much additional detail not apparent in the reproduction facing page 28.

## LAND USE REGIONS IN THE LONDON AREA EARLY IN THE NINETEENTH CENTURY

In modern times, the preparation of land use maps of counties and similar extensive areas is often followed by attempts to delimit and describe land use

[1] Emmison, F. G., 'County Maps of Essex,' Chelmsford, 1955, p. 10.
[2] British Museum, Maps: M.T. 6.b. 1 (12).

regions within which men have chosen to employ the land in unitary fashion. Dr. E. C. Willatts states that in preparing his regional division of Middlesex and the London Region published in Part 79 of "The Land of Britain" (1937) he found it necessary to examine a wide range of information. "Relief, soils, geology, drainage, natural vegetation and farming systems have all been considered . . . supplemented by personal observations based upon repeated field observation." [1] It is clear that the historical geographer is not able to call upon that range of facts about a past age which is essential if a satisfactory delimitation of former land use regions is to be achieved. For example, little information is now available about soil conditions around London at the beginning of the nineteenth century. The present quality of these soils may differ greatly from their former state, as the hand of man is continuously altering their texture, structure and chemical composition. For this reason, it seems appropriate to couple Milne's map with an almost contemporary description of farming systems and land use belts in the London area rather than to attempt a wholly new regional division, based upon map analysis alone. The Reverend Henry Hunter, in his preface to Volume II of "History of London and its Environs," published in 1811, described the face of the land around the capital in terms of a series of concentric belts, each displaying a measure of unity of farming practice. Hunter drew no map to illustrate his account, but included sufficient place-names to make it possible to base a generalized land use map of the London area, with the assistance of Milne's map in the placing of boundaries.

*The zone of clay-pits.*—The urban nucleus was surrounded, according to Hunter, by a zone in which "the face of the land is deformed by the multitude of clay-pits from which is dug the brickearth used in the kilns which smoke all around London." [2] At night, a "ring of fire" and pungent smoke encircled the City. The excavations for brick-earth associated with the Taplow Terrace of the Thames, had a short life but yielded great profit. It was customary to remove the top 4 feet of brick-earth, manufacture bricks on the spot at the rate of 4 million per acre, and then to fill without delay the cavity with a mixture of rubbish, manure and top-soil so that the site could be used for building, for pasture or crops. The scale of Milne's map allows few pits to appear, but large unfilled ones may be seen near Mile End and in Southwark. The words "Gravel Pits" are printed across the district north-west of Kensington Palace.

*The zone of cattle pastures.*—A kind of Green Belt ring, or as Hunter describes, "a green and open tract which gives a pleasing rural character to the immediate vicinity of the town," surrounded the innermost zone of clay and gravel pits. The zone was widest north of the Thames, where it extended for 3 miles from the line where London Clay first emerges from its covering of river-terrace gravels to the foot of the Hampstead–Highgate ridge. South of the river, gravel-capped spurs, such as Blackheath, Wandsworth and Wimbledon Commons, capped by grasslands of lower quality, restricted the width of the pastoral zone, but expanses of alluvial meadowland were found in the Lower Wandle Valley, near Dulwich and also west of Deptford. The pastoral zone was "almost entirely in the possession of the cow-keepers who provide the metropolis with milk." [3] The dairy-farmers manured the meadows to maintain a supply of fresh grass until mid-winter and then fed their

[1] Willatts, E. C. "Middlesex and the London Region," Part 79 of the Report of the Land Utilization Survey of Great Britain (1937) p. 172–4.

[2] Hunter, *op. cit.*, Vol. II, p. 2.

[3] *Ibid.*, p. 3.

*Section of Milne's "Plan of the Cities of London and Westminster... 1800." Scale 2 inches to 1 mile*

By courtesy of the British Museum

*Section of Rocque's map of Middlesex, 1754, 2 inches to 1 mile*

*By courtesy of the British Museum*

cattle in the stall with turnips, hay and brewer's grains until the spring flush of grass was ready.

Beef cattle were mainly found on drained marshland pastures in the Lower Lea Valley, the Rotherhithe area and the Isle of Dogs. Milne's map shows the excavations for the West India Docks which had newly separated the Isle of Dogs from the mainland, and the eight newly built windmills which lifted water from the drainage ditches of an area famed for the size of its beasts.

*The zone of market gardens.*—Hunter describes a belt of market gardens and nurseries bordering the Thames and therefore breaking the continuity of the concentric arrangement of zones. The belt extended from Bow, east of London to Hampton, about 15 miles to the west. Milne's map shows that the belt conformed to the width of the outcrop of Flood Plain Terrace Gravels of the Thames and Lea Valleys. The core of the market-garden belt lay in the parishes of Isleworth and Brentford, where orchards of apples, pears and cherries yielded an "upper crop" with an "under crop" of strawberries and raspberries planted between the trees. The orchards were surrounded with high walls, on which peaches, plums and nectarines were trained. Round the core, Hunter found three sub-divisions of the market-garden belt in which other crops were equal in value to fruit and vegetables. The first of these, the river-banks and islets between Fulham and Staines, had numerous osier-beds for basket and sieve making. The second, in the parishes of Fulham, Hammersmith and Chelsea where the persistence of open-field cultivation made specialized cultivation difficult, grew large quantities of barley and wheat in rotation with vegetables. The third, the western end of the market-garden belt in Twickenham and Hampton, had a distinctive character owing to the many parks and pleasure grounds which stood among the market gardens. The hothouses of gardens such as those of Hampton Court, Osterley Park and Syon House produced exotic fruits such as pineapples, apricots and grapes.

*The zone of hay.*—The outermost zone, according to Hunter, was chiefly devoted to growing hay for sale in the London market. The best hay meadows were the drained marshes of the Lea Valley, of natural grass freely manured so as to yield two crops in each year. These were more productive than the high meadows on the glacial and other drift deposits crowning the ridges at Finchley, Harrow and Hendon, which were artificially sown with rye-grass and yielded only one crop a year. The remoter parts of the hay-growing zone, where hay could be profitably sold only in favourable seasons, practised ley farming with clover and grass taking their turn with grain crops.

The hay zone of north Middlesex gradually merged into the market-garden belt adjacent to the Thames by way of a transitional area of mixed farming in which there was a slight preponderence of arable land. This wedge-shaped transitional zone, broadening westwards from Acton through Ealing to Hanwell and Uxbridge, contained areas which since Elizabethan times had been famous for their grain, such as Heston for wheat and northern Chiswick for barley. The river-terraces of the River Brent, and the many outliers of Lower Tertiary loams give the soils in this zone a lighter character than the heavy London Clays to the north and south of it. The unpublished Crop Returns to the Board of Agriculture in 1801 show an almost perfect balance between arable and grassland in parishes such as Hanwell and Ealing.

The combined area of the four agricultural zones surrounding the capital was computed by Hunter as 240 square miles, which is almost exactly the area covered by Milne's map. Half this area was meadowland and pasture, one-fifth was arable,

one-fifth consisted of market gardens, nurseries and pleasure grounds, and the remaining tenth was "unprofitably occupied" by wastes and commons such as Hounslow Heath and Norwood Common. In these haunts of half-starved and half-wild sheep, highwaymen found refuge.

It has been shown that hitherto neglected sources may be used to give a full and quantitative picture of land utilization in the environs of London at the beginning of the nineteenth century. The outlines of this picture were already clear from the "General Views" of the agriculture of the counties surrounding London which were prepared for the Board of Agriculture; Middlesex by John Middleton in 1798, Kent by John Boys in 1794 and Surrey by William Marshall in 1798. These reports were concerned with agricultural practices rather than with distributions, and the few maps they contain are of limited value. The unpublished Crop Returns of 1801 provide statistics of the areas under various crops for a number of parishes, but not all the parish clergy sent reports to the Home Secretary.[1] Maps showing surface utilization by Rocque, Rocque and André, Chapman and André and others are available, but their reliability is reduced by the absence or inadequacy of field boundaries. Milne's map and Hunter's account of agricultural zones are therefore substantial additions to knowledge of the pattern of land use in one of the principal farming areas of England a few years before it became engulfed by the tide of London's suburban expansion.

It has also been shown that the modern technique of land-use mapping has a reputable and lengthy ancestry. Milne's map anticipated by more than a century the method of recording the use of land, so successfully employed by the Land Utilization Survey of Britain that its basic scheme is being extended and adapted to fulfil the needs of the newly-launched World Land Utilization Survey. Thomas Milne planted a tiny grain of mustard-seed which for long remained dormant, Professor Stamp and his colleagues of the Survey reared a sturdy plant which may soon grow into a great tree with branches extending far and wide.

ACKNOWLEDGEMENTS

Mr. R. A. Skelton, the Superintendent of the Map Room at the British Museum, brought Milne's map to light by exhibiting it in 1953. I owe many valuable suggestions to him, and to Professor H. C. Darby and Dr. E. C. Willatts. This account is based on a paper read to Section E of the British Association at Bristol in September 1955.

[1] P.R.O., H.O. 67. These returns are described by H. C. K. Henderson, *Geogr. J.* 118 (1952) 338–45.

# AUSTRALIAN NATIONAL ANTARCTIC RESEARCH EXPEDITION, 1955

PHILLIP LAW

ON SATURDAY, 13 February 1954 a new Australian Antarctic station was established on the Mac-Robertson Land coast and named Mawson.[1] Early in 1955 a relief expedition led by Phillip Law visited Mawson and replaced the pioneer team of ten men, under Robert Dovers, with a team of fifteen men led by John Bechervaise. On the way to Mawson the relief expedition carried out exploration along the Princess Elizabeth Land coast. The following account of this voyage is given by the leader, who is Director of the Antarctic Division, Department of External Affairs, Australia.

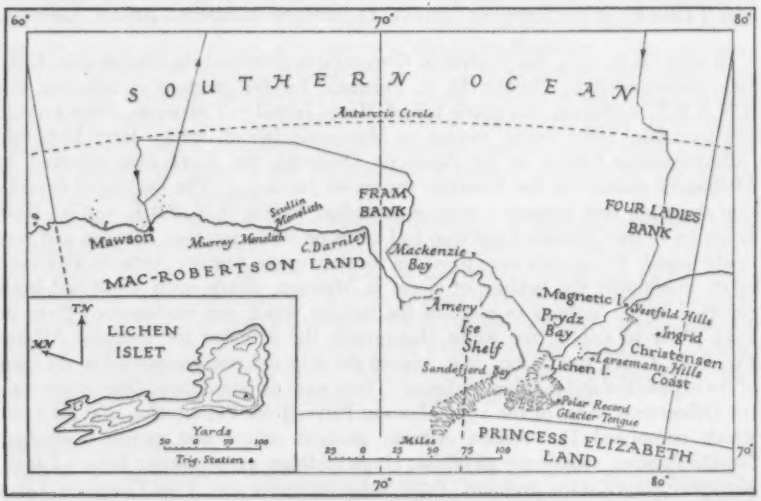
In 1955, as in 1954, the Australian Government chartered the Danish ship *Kista Dan*, commanded by Captain H. C. Petersen, for the purpose of relieving the A.N.A.R.E. stations at Macquarie Island, Heard Island and Mawson. After a quick and successful three weeks' voyage to Macquarie Island, led by Jerry Donovan (Administrative Officer of the Antarctic Division), the *Kista Dan* returned to Melbourne to load for the Antarctic voyage on January 4. The loading of expedition ships has now become a routine procedure for the A.N.A.R.E. and by 1900 hours on Friday January 7 the ship had taken on some 350 tons of stores and was ready to sail. No aircraft were provided for the voyage, but two Army DUKWS were taken to simplify the landing of stores at Mawson, where open water had been reported in the harbour in place of the fast-ice which was encountered there in 1954. Prior to sailing, the Right Honourable the Minister for External Affairs, Mr. R. G. Casey, C.H., D.S.O., M.C., visited the ship and was introduced to the men of the expedition and the ship's officers. There were on board, in addition to myself, the Officer-in-Charge of the 1955 Mawson Party, John Bechervaise, and his team which comprised Dr. Robert Allison, medical officer and second-in-charge; Neville Parsons, cosmic ray physicist; Hugh Oldham, geophysicist; Robert Lacey, surveyor; Peter Crohn, geologist; Peter Shaw, meteorologist; Fred Elliott and Leon Fox, weather observers; Fritz Van Hulssen, radio supervisor; Eric Macklin and Jack Ward, wireless telegraphists; Alan Gowlett, diesel mechanic; Alf Riddell, carpenter; and Dick McNair, cook; the officer commanding the Army DUKW team, Lieutenant Tony Hall, and his two men, Lieutenant William Bathurst and Corporal Cecil Power; my lieutenant for the voyage, Richard Thompson; and two men from the Australian News and Information Bureau, journalist Tom Hungerford and cameraman George Lowe. Twelve of the fifteen Mawson men had served previously with the A.N.A.R.E. at one or other of the island stations.

As the Australian Government had decided to close the Heard Island station, I planned to call at the island on the way south and to transfer certain huts, mechanical equipment and the huskies from there to Mawson. The journey there took sixteen days and was, in addition to being as tedious as usual, extremely uncomfortable. On seven days the wind blew with Force 6–7, on six days it was Force 8 and on one day Force 9. We anchored in Atlas Cove at 0410 hours on January 23, in a strong north-westerly wind and a heavy north-east swell, and conditions for loading were dangerously difficult. But by dawn on Tuesday January 25 the

[1] See *Geogr. J.* **120** (1954) 409–21.

weather had improved, and we were able to complete operations at Heard Island and to sail for Antarctica that evening at 2109 hours.

We made good progress on our course for Prydz Bay until Friday January 28, when Force 8 winds from the W.N.W. forced the ship to heave-to between the hours of 0600 and 1600. This delay was exasperating as it had been expected that the ship would enter the pack ice belt on Friday evening. Large numbers of icebergs were first encountered in the region of the Banzare Bank: this was almost 500 miles north of where we first sighted them last year! This was not unexpected, as the 1954 Heard Island party had sighted icebergs for the first time for some years and two were aground off the south-west coast of the island when we arrived. Messages from Mawson stated that no fast-ice was left and that no pack ice could be seen to the north, so there was no doubt that the ice conditions




this year differed considerably from last. The ice edge was encountered on Saturday January 29 in position lat. 66° 17′ S., long. 77° 43′ E., and shortly after lunch we began to sail over the Four Ladies Bank through a great accumulation of grounded icebergs. The minimum depth registered was 60 fathoms. The day was calm and dull and good progress was made through open pack. We stopped for the night at 2230 hours in heavy pack. Sunday January 30 was a magnificent day—clear, sunny and calm. Progress was resumed at 0430 hours and, after pushing through some heavy pack, we ran out into open water at 0530 hours and sailed through lines of icebergs directly for the "Vestfold Hills." [1]

Our destination was "Magnetic Island," where we landed in 1954, but our direction of approach differed. Speed was reduced to dead slow and, with echo-sounder running, the ship edged her way forward between numerous islands which were bare of snow and covered with extensive Adélie Penguin rookeries. At 1140 hours there was a grinding jar, the ship lurched and bucked several times before the way

[1] Place names in quotation marks have not yet been shown on official Australian maps and charts. They are marked on the map with an asterisk.

could be taken off her and we found ourselves stranded on top of a sharp pinnacle of rock which had passed to one side of the echo-sounders without registering and had struck the ship amidships. It took half an hour's manoeuvring by the captain to get clear again. Fortunately the ship has a 2-inch keel plate and 1-inch plating elsewhere below the waterline; nevertheless, it was not a pleasant sensation to be aground so far from home. We retraced our path, made another approach, and anchored off "Magnetic Island" in 9 fathoms at 1400 hours. Bearing in mind the way in which a snowstorm last year had robbed us of the chance to investigate this region thoroughly, I set into action immediately a plan drawn up earlier for a concerted attack upon the area, by groups detailed to obtain specific information.

First, Dick Thompson and the Second Mate, Bill Petersen, took a party of four scientists in the ship's motorboat to "Magnetic Island" where, between 1530 hours and 2030 hours, they commenced observations of position, magnetism, gravity, geology, ornithology and botany. In the meantime I took two DUKWS, under the command of Lieutenant Tony Hall, and a party of eleven men to the mainland with full camping equipment. We landed further to the north of last year's landing: the DUKWS had to push ice floes out of the way to make a landing on a good flat beach, and the second DUKW bogged and had to be winched out by the first. We then ran the DUKWS in nearly a mile before deep, soft soil (where a DUKW again bogged) and a field of boulders forced us to stop. A good camp site on rock and snow was chosen near the shore of a lake, which turned out to be brackish. When the DUKWS were unloaded I sent them back to a spot from which they would have no difficulty in returning to the beach in case of a heavy snowfall.

While some of the men set up camp, three of us made a preliminary examination of the surrounding country. We walked about 8 miles, visited two lakes and one fjord-type inlet, and were away three hours. Upon our return we had supper and cleared up while the others covered a further area. We retired for the night at 2330 hours, four men in a pyramidal tent, two men in a small mountain tent and five men in a covered DUKW. On Monday January 31 we rose at 0300 hours and prepared for a long walk over what is marked as "Breidneset" on the Norwegian chart.[1] We broke up into three groups—four led by Bechervaise, four by myself and three who were to remain at the camp. The two field parties started out together at 0630 hours and later diverged to explore what the Norwegians had marked as a long inland lake, my party following it towards the sea and the other party following it towards the continental ice cap. It turned out to be a fjord, not a lake. We returned at 1630 and 1830 hours respectively, having walked some 15 to 20 miles each.

We obtained a very good general idea of the area and upon our return immediately set out for the *Kista Dan*, arriving on board at 1930 hours. There we all met to discuss the day's work. I found that, on Monday, Thompson had landed the four scientists on "Magnetic Island" at 0700 hours to resume their work and had then made five unsuccessful attempts to land other men on some of the other islands. He was frustrated by a low tide and a fresh north-east wind which produced a surge on the rocks and iced up men and boat with frozen spray. These men were finally also landed on "Magnetic Island." The day's work was altogether highly profitable and a report is being prepared for publication. Last year's astrofix was repeated and confirmed; the magnetic station was reoccupied; gravity observations were made; extensive ornithological observations were taken and specimens of the rocks,

[1] Hansen, H. E., 'Atlas over dele av det Antarktiske Kystland.' Oslo, Grøndahl & Sons, Boktrykkeri, 1946.

soil, flora and lake water were obtained. An astrofix from the summit of "Magnetic Island" gave a position lat. 68° 32′ 39″ S., long. 77° 54′ 27″ E. The magnetic variation was 70° W.

In general the "Vestfold Hills" is a most interesting region. Covering about 300 square miles, this area is completely ice free in summer. Off-shore lie numerous small islands upon which, during the breeding season, several millions of Adélie Penguins breed. Great fjords, often frozen over, cut deeply back into the mainland rock, and in the valleys and depressions lie numerous ice-free lakes, most of which are salt. The coastal fringe of the mainland is completely covered by moraine debris and erratics, while the inland country rock consists mainly of medium-grained charnockite gneisses, criss-crossed with fantastic black dykes of dolerite. Few penguins come ashore on the mainland, most preferring to make their rookeries on the islands. This is probably because the sea ice breaks out to leave open water around the islands at an earlier date than around the mainland. The area is apparently lashed at times by gales of great force which cast salt spray in summer far inland. This is probably the reason for the salinity of the lakes and for the sterile nature of the soil. The only lichens found were well inland almost at the junction of the exposed rock and the rising continental ice sheet behind. The average height of the hills is about 400 feet above sea level and the general scenery, with the warm chocolate-brown rock, the blue and white semi-frozen fjords, and the paler blue-green ice-free lakes, is glorious. Off-shore, beyond the islands, lies an accumulation of thousands of icebergs grounded on the Four Ladies Bank.

The *Kista Dan* headed south from "Vestfold Hills" at 0430 hours on Tuesday February 1 and encountered fast-ice at 1015 hours, north of the "Larsemann Hills." The ice was hard and blue and from 3 to 4 feet thick. The ship could not break through it, but a lead was found which enabled the Captain to take the ship around to the east to approach the shore more closely, and at 1330 hours we tied up against the fast-ice about 12 miles off "Larsemann Hills." I decided to try a dash over the fast-ice to reach the coast, as the day was perfect, cloudless and calm, and the ice was far stronger and thicker than that over which we carried out all our unloading last year at Mawson. After lunch a Weasel, a caravan and a dog sledge were hoisted out and we selected the articles needed for a nine-man party. We planned to have the Weasel tow the caravan and hand-hauling sledge over the ice 12 miles to the mainland, to return to the ship, and to await my radio message to fetch us back again.

The main object of the journey was to obtain an astrofix on land which, with that already obtained at "Vestfold Hills," would enable aerial photographs of the whole Ingrid Christensen Coast to be accurately plotted. Such a fix is needed urgently by the National Mapping Section for its revision of the Australian Map of Antarctica, by the U.S. authorities who are endeavouring to plot information from the aerial photographs of U.S. Operation High Jump (1947) and by the Norwegian authorities whose charts of this area are inaccurately orientated because of the lack of ground fixes for plotting the Lars Christensen aerial photographs of 1937. We set out at 1730 hours in bright, warm sunshine, and perfectly calm weather. In the first quarter mile we ran through two weak spots in the ice, where the Weasel broke the surface and left a depression some yards wide filled with sea water. Half a mile from the ship we again were nearly held up by a similar break-through. Even the closest inspection, together with probing, failed to disclose these weak spots. When discovered, marker flags were placed as warnings for the return journey.

When about 2 miles from the ship we came across the first break in the fast-ice

—a crack about 2 feet wide filled with salt water. We could easily have crossed this using the bridging timbers we carried, but I was concerned that the crack might widen and leave us stranded on the other side. I was also worried by such major cracks in what appeared otherwise perfectly solid, fixed ice. I decided to have a close look at the whole situation. We therefore followed the crack along towards a group of icebergs and it narrowed to a gap only a few inches wide. However, for half a mile around the icebergs the ice was weak, with numerous cracks and blow-holes, around which were lying Weddell Seals. I did not favour the area as a critical point on our return route.

At this stage I climbed on to the roof of the Weasel with binoculars and surveyed the prospect ahead. From this position I could see blue water surrounding the rocky island which was my objective; all other rock outcrops within a reasonable distance were separated from us by suspicious looking cracks; and in general the situation looked much more tricky than it had from the ship. I considered it was not worth risking the loss of a Weasel and decided to return to the ship. On the way back we noted several small cracks which had not been there on our way out, and when only 30 yards from the ship the Weasel broke through and left a hole 8 feet long but somehow kept going and pulled out of it. We arrived at the *Kista Dan* at 2030 hours. After dinner, at about 2130 hours, the ice broke up for no apparent reason. There was no wind and no swell. In less than half an hour the whole area for some miles around the ship had cracked up. It was curious to see large disconnected floes drifting along, separated by wide lanes of water, each floe bearing the track marks of our Weasel.

Next day, Wednesday February 2, the Captain worked the ship in through the broken ice past our Weasel tracks towards the unbroken fast-ice, the object being to secure the ship and obtain a noon position. We stayed until 1616 hours and obtained a good fix, the Captain working out on the ice using an artificial horizon for his sextant. From this position we sailed for Sandefjord Bay and at 2000 hours we moored against an edge of fast-ice in the shadow of an ice front which proved later to be the terminal edge of the feature discovered and named "Polar Record Glacier Tongue" by the U.S. Authorities from Operation High Jump photograph. To the south could be seen rock outcrops behind massed icebergs. The rocks were apparently the islands of what are marked on the Norwegian chart as "Bilingen". I decided that, provided no open water separated us from them, it would be better to attempt to reach these islands by hand-hauled sledge than by Weasel, and that a landing here would do quite as well as a landing at the "Larsemann Hills." I therefore asked Bechervaise and his men to pack a sledge for a six-man party while Thompson and I set out at 2110 hours on skis to reconnoitre the fast-ice near the ship. We were away until 2315 and covered about 5 miles. We climbed onto the glacier tongue and found the surface good, with occasional small crevasses up to 2 feet in width. The fast-ice seemed solid, with a few new cracks less than an inch wide here and there but probably as stable as such floating ice can be at this time of the year. When Thompson and I returned we found that the ice at the ship, weakened by the ship's repeated charges to break a small harbour for itself, had broken up for about a mile southward. I decided to risk a sledge journey aimed at one of the islands 12 or 15 miles to the south. We would follow the glacier tongue for the first 8 miles and in case of a break out could return over the glacier tongue. If the ice were to break up, I hoped that either the ship could move in to pick us up or the ice would drift out past the ship.

Next morning, Thursday February 3, dawned with a dropping barometer, a

north-east wind, and heavy black clouds looming in the northern sky; but the expected storm did not arise and the day smoothed out into one of dull greyness, snow showers and a 20-knot wind. At 1730, in a snow shower, with bad visibility, our six-man party set off for "Bolingen" towing a sledge which, with its load, was estimated to weigh between 700 and 800 lbs. The party comprised Bechervaise, Shaw, Lacey, Crohn, Ward and myself. The pulling was hard and stops were frequent as we had to adjust ski bindings, or as skins came off the skis. At 2118 hours we had travelled 4.2 miles and had put up our third marker flag below the glacier tongue cliffs when we were forced to leave it and move out in a more easterly direction because our way ahead was blocked by a jumbled mass of icebergs, pressure ridges and water cracks in a region where at one stage numerous icebergs had been forced hard up against the eastern side of the glacier tongue.

From here on the task of finding a suitable route demanded my whole attention, for the sledge was too heavy for us to haul over obstacles, and pressure ridges had to be avoided. The area ahead was a maze of icebergs and most of the gaps between them were blocked by tumbled masses of ice. The islands could not be seen. I had thought that the surface on which we were travelling might have risen, to form a more permanent form of bay ice, but I was disappointed to find swell cracks with newly frozen sea water around these icebergs, so we were apparently still travelling over sea ice only a few feet above sea level. Shortly after midnight, in a dim and eerie half light, I set a course for a narrow but most distinctive gap between two large icebergs and prayed that it might not be blocked. We reached it at 0150 hours on Friday February 4, all very weary and hungry. We had been hauling for over seven hours and had partaken of only some lemon drink and a little chocolate. The light was too bad to distinguish surface contours and it was too cold for a meal in the open, so we decided to make camp and snatch a few hours rest. While Bechervaise supervised the erection of two small tents, Shaw and I skied around through the gap. To our delight we saw an island rock outcrop only about 2 miles ahead and decided to make it our destination instead of the more distant one originally envisaged. The gap itself did not reassure us. It was a mass of swell cracks, with much newly frozen black-ice and pressure ridges and some open water. A slight swell made the giant icebergs appear to heave and sag as one stood beside them on the gently moving sea ice. It was with some trepidation that we lay down to sleep in our tents in this area at approximately 0400 hours, but we were too tired to worry for long and slept soundly until 0800 hours.

It was 1130 hours when we left and successfully negotiated the ice of the Gap. Ahead within easy reach was our goal, but I was concerned lest swell or a change in the weather should break up the unstable ice in the Gap before we returned and cut off our only retreat path. We reached a small islet (later identified as that called "Lorten" on the Norwegian chart) at 1245 hours and found it surrounded by some 30 yards or so of black-ice. The rock was fringed with an ice collar 5 feet above the black-ice, indicating the high-tide mark, and beneath this collar the black-ice had melted and a few yards of open water lapped the rocks. A slight swell of 5 to 8 inches was noted.

The afternoon was spent on investigations at the island and at 1800 hours we pitched our camp on the highest bit of sea ice we could find. I did not wish to camp on the island in case the black-ice broke up and left us marooned. On the other hand, I could not find any large, thick ice floe or any accessible iceberg upon which to set our tents, so had to be satisfied with a site on fast-ice only a few feet above sea level which did not differ much from any of the rest of the ice around us.

At 2200 hours we received a warning by radio from the ship that strong winds and a five-foot swell there had broken up the sea ice for a mile or two along our outward track. We retired to bed at about 2300 hours in weather that appeared "set fair."

At 0300 hours on Saturday February 5 I awoke to find a fresh north-east wind blowing and snow driving horizontally past the tents. I awakened Peter Shaw (meteorologist) who agreed that the weather looked ominous. The possibility of a hurricane setting the whole area into heaving motion, with floes crumbling and icebergs rolling and crushing the sea ice to fragments, was not a pleasant prospect, so I woke the others and ordered a move onto the island. We worked fast and by 0430 hours we were on our way. Our new camp on the island was established by 0600 hours. The morning fined up, the gale did not develop, and the wind blew lightly from the east. Crohn closely examined the rocks of the island, Bechervaise collected lichens, Lacey took sun shots, Shaw and I assisted him and took panoramic photographs and Ward attended to the radio schedules with the ship. The island proved most interesting. Although it boasted no penguin rookery it was apparently used as a roosting place by moulting penguins whose guano had stimulated a prolific growth of lichens, algae and mosses. We decided to rename this small remote rock "Lichen Islet," and Lacey fixed its position as lat. 69° 20′ 0″ S., long. 75° 31′ 58″ E. The magnetic variation was found to be 71° W. In contrast to the "Vestfold Hills" region, the island was free from erratics and glacial debris. The country rock consisted largely of medium-grained biotite para-gneisses, grading locally into biotite hornfelses, and showing irregular folds. Occasional veins of glassy quartz were noted but there was a complete absence of basic dykes.

On the sledge journey we saw numerous MacCormick Skuas and Wilson's Petrels. Groups of Emperor Penguins were passed at intervals, fourteen to twenty in each group, standing patiently like passengers waiting for a bus. It was evident that there was an Emperor rookery somewhere along the coast to the south of the island. Several Snow Petrels were seen and from the summit of Lichen Islet I discerned a Giant Petrel alight on a seal carcase and chase off the skuas. Some fifty Weddel Seals were counted on the sea ice to one side of the island. The tidal rise was about 4 feet. Lacey had barely completed his noon observations when the sun disappeared behind cloud and did not reappear. I decided to return and we began to pack up; we heard from the ship that they would push in towards us through the broken-up ice. It was 1730 hours when we left, the temperature had risen and the snow was thawing. This and the slight swell visible on the rocks made me wonder in what condition we would find the ice at the gap, and we made a fast run across the ice to this landmark. Fortunately, the way through it was clear in spite of some newly formed cracks and we could see the ship dead ahead in the distance. Its change of position had not only shortened our return route but had straightened it out, so that we could proceed direct and avoid the difficult route through the maze of icebergs. As the evening wore on and the temperature fell, the hauling became harder, but we were no longer troubled by irritating delays due to skins and ski-bindings and made good progress. When we were 3 miles from the ship the fast-ice began to deteriorate. First there were fine cracks, then wider ones, finally cracks 2 feet to 6 feet wide which opened and closed with the swell. The surface of the ice was 18 inches above the water and the floes about 5 feet thick. We crossed any cracks less than 3 feet wide and detoured around wider ones. Occasionally we were forced to wait until two floes drifted together before we could cross the intervening gap. Slowly we approached the *Kista Dan*, and fortunately

the weather remained clear and fine. Most cracks were at right angles to our path and over the last half mile the floes were held together by the ship, which pushed its bows against them and steamed steadily to stop the cracks from broadening. We were taken on board at 2315 hours, cold and hungry but very satisfied with the results of our journey, which had showed me that unless the absence of fast-ice at some future date permits a ship to sail through open water to the coast there is little chance of any person reaching this group of islands, unless by helicopter. The treacherous nature of the sea ice in summer and the tumbled confusion of the icebergs and pressure ice provide an almost insuperable barrier to any curious adventurer.

On Sunday February 6 the ship began to push out of the ice at 0625 hours en route for Sandefjord Bay. This took much longer than we expected and we did not reach open water off the tip of the "Polar Record Glacier Tongue" until 1300 hours. We sailed around the glacier tongue and found fast-ice and pack ice jammed across the lower end of Prydz Bay. The entrance to Sandefjord Bay was seen to be as narrow as five or six times the height of the ice cliffs forming it. The whole area before and behind this entrance was cluttered up with icebergs and tumbled sea ice and appeared quite inaccessible to any ship. Judging from what I had experienced on the other side of the glacier tongue it would not be practicable for a party on foot to penetrate into Sandefjord Bay. I was very sorry we had no aircraft, for the open water here would have permitted a most valuable flight. The weather was mild, calm and overcast, with occasional snow showers. At 1615 hours the ice front of the "Amery Ice Shelf" [4] was visible and soon the ship swung to the north to follow it. The ship's officers commenced an accurate plot of the ship's course and of the coast in relation to it, using the radar, and I set Elliott sketching the radar screen at regular intervals. Soundings were taken continuously. After dinner we passed through some pancake ice, the first for the voyage. We pushed on until 2247 hours when lack of light forced a stop. There was no ice thick enough to moor the ship so the engines were kept going all night. At this stage we were lying off the point where the ice shelf swings westward into MacKenzie Bay.

On Saturday February 7 the ship started at 0610 hours and picked up the corner of the ice shelf again. Shortly after, the Captain asked me to join him in the crow's nest. He pointed out that the ice was thickening ahead and looked far from promising. At 0800 hours we began to push very heavy pack ice and I began to doubt whether we could continue for much longer. However, from the crow's nest the Captain saw a weakness in the ice and broke through to the south-west to reach open water right against the ice shelf. This was indeed a triumph and we proceeded very happily in the assurance that we could now complete the charting of the whole coastline in this region. Once again I wished that we had an aircraft! From 1000 hours until 1700 hours we followed the coast in open water. The sun came out and permitted an accurate fix of our course and, with radar distances, depth-soundings and photographs, we made the most of our opportunity. At 1400 hours we passed the south-west corner of MacKenzie Bay and found it to be the point of junction of the "Amery Ice Shelf" and the continental plateau. We proceeded nearly three-quarters of the way up the western coast of MacKenzie Bay toward Cape Darnley until at 1700 hours we were forced to leave the coast and turn seawards by a belt of heavy pack ice, icebergs and fast-ice. This great accumulation of ice was assumed to mark the southern limit of the Fram Bank. By midnight on Monday we had rounded Cape Darnley in open water, passed north of the Fram Bank, and were proceeding westward towards Mawson. On Tuesday we were about

60 miles north of Mawson at 1400 hours and turned south. At 1630 hours we first saw the plateau and the ranges behind Mawson; we met open pack ice at 1650 hours and dense pack at 2000; and we stopped in ice for the night at 2153 hours. On Wednesday February 9 the ship pushed on at 0600 hours and at 0830 hours broke free of the pack into open water and steamed towards Mawson. We dropped anchor just outside the harbour at Mawson, at 1155 hours.

As a result of fine weather, unusually good ice conditions and the skill with which Captain Petersen handled his fine ship *Kista Dan*, we had successfully explored some interesting ice-free regions of Princess Elizabeth Land, obtained valuable scientific data and carried out a running survey of the west coast of Prydz Bay. As a result of the astrofixes obtained at "Vestfold Hills" and "Lichen Islet" during this voyage, and at Scullin Monolith and points as far west as King Edward VIII Gulf by Robert Dovers during 1954, it is possible now to correct the detailed Hansen aerial charts of the Antarctic coast from Princess Elizabeth Land to Enderby Land.

# SUBSIDENCE IN THE MID-CHESHIRE INDUSTRIAL AREA

K. L. WALLWORK.

SUBSIDENCE IS A common phenomenon in the mining districts of Great Britain, but nowhere has it been so persistent, serious and disruptive as in the mid-Cheshire industrial area. Mid-Cheshire consists of three salt and chemical manufacturing towns—Middlewich, Winsford and Northwich—together with a group of villages-cum-suburbs surrounding the latter. The district's major industries—salt and chemical manufacture—are both dependent on salt as a raw material. Their increasing exploitation of the salt deposits was accompanied by serious subsidence, caused by the mining of rock-salt and the pumping of brine. Subsidence in the salt-field tends to be more widespread than in coal mining districts, for the solubility of the exploited mineral, and the long distances over which brine flows to the pumping shafts, cause subsidence to occur at points distant from the productive areas. In this essay [1] it is proposed to deal briefly with the geology of the area, an important preliminary to full understanding of the growth of subsidence. This is followed by a description of subsidence itself, notably its modes of occurrence, its causes, and its historical development. Finally there is a section discussing the effects of subsidence upon the distribution of population and industry within mid-Cheshire.

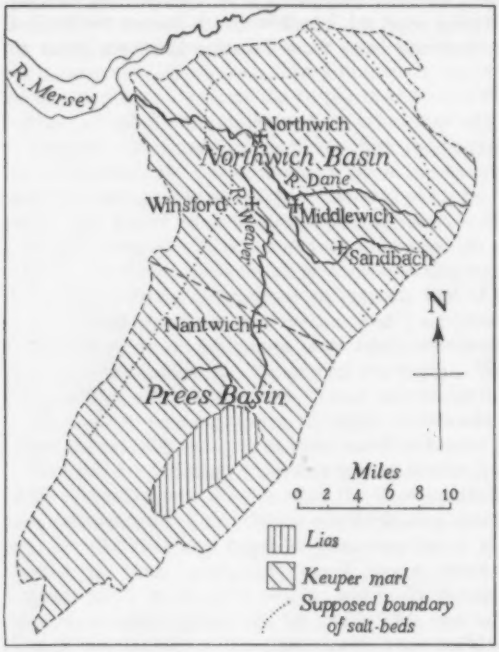



*Fig. 1. The Triassic Syncline (after Sherlock, op. cit.)*

Knowledge of the geological structure of mid-Cheshire is an important prerequisite of any study of subsidence. Geological features frequently decided the precise form taken by subsidence, although the causes were rarely, if ever, natural. The whole of the salt-field lies within the Triassic Syncline (see Fig. 1), which although essentially a single unit, is divided into two imperfect basins. The

[1] Mr. Wallwork's essay won the Society's undergraduate essay prize for 1955. Mr. Wallwork's is the first essay to be printed in the *Journal* since the award of the prize, suspended during the War, was revived in 1947.

northernmost of these—the Northwich Basin—contains the worked salt deposits. The rock-salt beds are not, however, conterminous with the Keuper Marls of the Syncline, nor is it easy to correlate sections in various parts of the salt-field. The Marls have been faulted, and eroded unevenly, so that rock-salt is found at varying horizons within the Keuper series. Nor is current knowledge of the extent of the salt-beds complete, as borings through the salt-bearing strata are restricted to the productive areas, which form but a small proportion of the whole. Even where such borings have been made, published information is scanty, and this accounts for the paucity of detail in the standard works on the subject.[1] In addition, the differing composition of the Keuper Marl within the area—an important factor in affording different degrees of resistance to subsidence — has scarcely been investigated. Yet despite these difficulties it is possible to give an adequate description of the salt-field, especially of the productive areas.

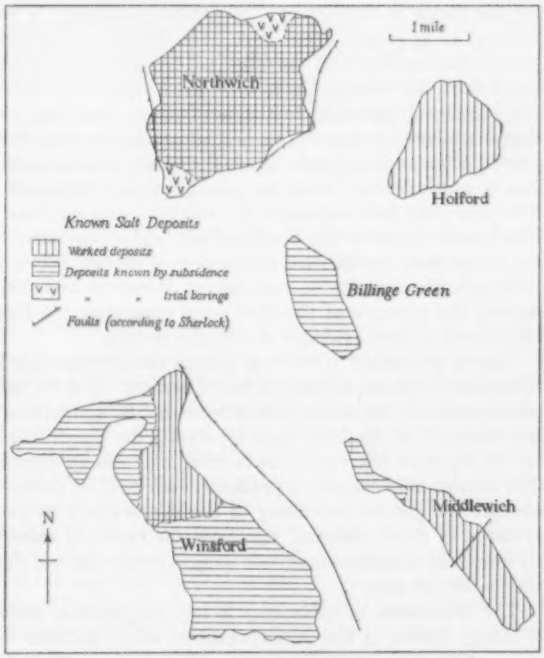



*Fig. 2. Salt fields in mid-Cheshire*

Four productive salt-fields may be recognized in mid-Cheshire, at Northwich, Middlewich, Winsford and Holford (see Fig. 2). It may also be assumed that the intervening areas are underlain by rock-salt, as yet unworked, of various thicknesses at varying depths, for the boundaries of the known deposits tend to be limited by economic factors. The geology of the rock-salt deposits has frequently been responsible for the precise form and extent of subsidence, and in the following paragraphs it is intended to give a brief outline of the geology of the area, to illustrate this point.

The Northwich salt-field was formerly of greatest importance, and was most severely affected by subsidence, due to the ruthless exploitation of its salt and brine deposits. At Northwich two major beds of rock-salt, separated by a band of Keuper Marl, and underlain by minor veins of salt, are recognizable. The Upper and Lower Beds—the major deposits—lie at depths of 214 and 334 feet respectively, and consequently were easily worked, a factor of considerable importance in aiding

[1] Sherlock, R. L., "Rock-salt and Brine," *Mem. geol. Surv. U.K.*, 1921; and A. F. Calvert, 'Salt in Cheshire,' London, 1915, are the standard works on the geology of the salt-field.

the growth of subsidence from its early stages. From the centre of the field at Marston the rock-salt beds thin out radially with rapidity, and the interbedded Marls split the major deposits into a series of thin veins, thus reducing their economic value, and their susceptibility to subsidence. In addition the salt-field is bounded to east and west by faults, which, with one important exception,[1] prevented the spread of subsidence to neighbouring areas. Furthermore the Upper Bed had been partially eroded by pre-glacial streams, whose valleys had become drift filled and provided yet another barrier to the expansion of subsidence.

The Holford salt-field, which is probably an extension eastward of that described above, separated from it by faulting (see Fig. 2), is now the most important producer of brine in the country.[2] It has never experienced subsidence, however, for the brine is derived by "controlled pumping," a technique which will be referred to in greater detail later. The Middlewich salt-field (see Fig. 2) has no proven relationship with the other salt-fields of mid-Cheshire, although, as will be noted later, the Billinge Green subsidence suggests interconnection between it and the Northwich salt-field to the north-west. Knowledge of the Middlewich salt deposits is limited to a narrow belt alongside the canal and the railway, which has proved economical to work. From the scanty evidence available it appears that the area is much faulted; thus the possibility of widespread subsidence is reduced. The dominant fault separates the salt-field into northern and southern sections. The known extent of the Winsford salt-field is also restricted by economic factors, for the worked deposits are confined to a narrow belt along the Weaver Valley. Although the deposits of rock-salt at Winsford and Northwich lie at different depths, the presence of the Marl band separating the Upper and Lower Beds in both districts gives evidence of their connection.

Thus it is possible to arrive at general conclusions regarding the extent and configuration of the salt deposits in mid-Cheshire. That the salt deposits were formerly continuous over the whole area is borne out by similarities in the strata, notably in the constancy of the Marl band separating the Upper and Lower Beds. This continuity has been interrupted by faulting, and also by denudation of the Upper Bed. The limitation in size of the productive salt-field by economic factors has tended to obscure the general continuity of the salt deposits by providing little superficial evidence of their existence. However, the extent of subsidence is not determined by economic considerations, and its occurrence has not therefore been confined to the productive area.

The importance of subsidence in any geographical description of mid-Cheshire is clearly shown in the following table, which outlines the main phases of subsidence, their causes, and the areas affected during each. The effects of subsidence upon the distribution of population and industry will be noted briefly below: in this section emphasis will be placed upon the causes of subsidence, its unique geomorphology, and its historical development. Two types of subsidence may be recognized, the second having three variants. The first type consisted of funnel-shaped holes, which were formed on the collapse of rock-salt mines. The second consisted of trough-like hollows, of varying sizes and configurations, which resulted largely from natural-brine pumping. It is proposed to treat each type of subsidence separately, for although this entails certain breaks in chronology, it enables each type to be described in continuous narrative.

[1] This is the Billinge Green subsidence, described on page 46.

[2] Sixty-five per cent. of the nation's brine—approximately 2,000,000 tons of salt in solution, is produced annually at Holford.

SUBSIDENCE PHASES IN MID-CHESHIRE

| *Phase* | *Characteristics and causes* | *Locations affected (see Fig. 3)* |
|---|---|---|
| Rock-salt mining subsidence. 1750–1870. | Large funnel-shaped holes, caused by collapse of rock-salt mines. Later occurs in association with brine pumping subsidence. | Northwich (Witton and Dunkirk), Marston and Wincham. |
| Natural-brine pumping subsidence. 1790–date. | Trough-shaped depressions of varying dimensions, according to thickness of overlying strata and geographical disposition of pumping shafts. | Winsford, Marton; Billinge Green; Middlewich; Northwich, Wincham, and Marston. |
| Flooded-mine pumping subsidence. 1873–1935. | Combination of funnel-shaped holes and trough-like depressions caused by pumping brine from flooded rock-salt mines. | Northwich (Witton and Dunkirk), Wincham and Marston. |
| Controlled brine pumping. 1924–date. | NO SUBSIDENCE AS YET | Marston, Holford and Wincham may be affected. |

The funnel-shaped holes, formed on the collapse of rock-salt mines in the Upper Bed at Northwich, were a transient feature of the landscape, for they were all engulfed by later, more serious subsidence. They were the first form of subsidence to be noted, and resulted mainly from bad mining practices.[1] Insufficiency of the supporting pillars in the mines, percolation of water through incipient cracks in the roof, and direct entry of water via the mine shafts were the principal causes of destruction. Fresh water, on entering the workings, rapidly damaged the already weak supporting pillars. The ease of mining the rock-salt deposits meant that new pits were sunk in preference to taking costly preventive measures in old ones which were liable to collapse. In addition, the proximity of the mines to one another and to the waterways used in the carriage of rock-salt increased the dangers of subsidence and the subsequent flooding of land in the vicinity of the mine. The collapse of any mine endangered its neighbours, and this was especially true of the dense concentrations along the valleys of the Weaver and Wincham Brook, where flood-water spread rapidly through the workings once subsidence had begun. Nevertheless the collapse of the mines was not a serious problem, for subsidence was localized about the mine shafts, which were at some distance from the densely populated areas of Northwich. However, it became obvious that mine collapse alone was not responsible for the expansion of subsidence, for the area submerged due to subsidence was far greater than that covered by the abandoned mines.[2] There was either

[1] T. Ward says "Very few of the subsidences resulted from bad mining" (*Manchr geol. Min. Soc. Trans.* **25** (1898) 537). Had good mining practices been observed, however, water would never have been allowed to accumulate in the mine workings as it did. Ward's contention should be confined to the fact that collapse of the supporting pillars was rarely entirely to blame for subsidence, and not to absolving mining practices in general.

[2] Ward, *ibid.*, points out that of 90 acres affected by subsidence, only 13 were underlain by rock-salt mines.

considerable natural wastage of brine, or excessive removal of salt in suspension by brine pumping; it is to the latter that the expansion of subsidence must be attributed.[1]

The second phase—natural-brine pumping subsidence—began in 1790, and continues to the present day. Between 1790 and 1840 the first two phases overlapped, but after 1840 natural-brine pumping subsidence gained ascendancy, and has been the cause of widespread damage throughout mid-Cheshire. Natural brine, which lay in quantity above the Upper Bed of rock-salt, was pumped by white-salt manufacturers in ever increasing quantities during the late eighteenth and the nineteenth centuries, and it was this excessive exploitation of the brine reservoirs which caused the occurrence of trough-like subsidence in mid-Cheshire. Its modes of occurrence and causes were more complex than those of the phase described above; nevertheless it is possible to recognize certain cause and effect relationships in this type of subsidence.

While the natural-brine reservoirs were full, and the demands upon them slight, there was little fear of subsidence, which results from excessive agitation of the brine and rapid solution of the rock-salt when the reservoirs are being replenished by fresh water. The great increase in salt manufacture during the early nineteenth century was responsible for the rapid depletion of the brine reservoirs in the vicinity of the salt-works. Consequently the pumps began to attract brine from a greater distance, which in flowing to the pumping shafts carved out "solution valleys" in the rock-salt. These "solution valleys" were deepest at some distance from the shaft, for here the brine was unsaturated, and had a greater capacity to dissolve the rock-salt than it had in the vicinity of the shaft itself. Thus subsidence tended to occur at some distance from the salt-works, where fresh water with its great erosive capacity first came into contact with the rock-salt. The character of the overlying strata, and the disposition of the brine pumping shafts were to a great extent responsible for the precise form and extent of this type of subsidence, as the following examples, typical of many in mid-Cheshire, show.

The first variation of the basic type of trough-like subsidence consisted of deep troughs, with terraced sides at their formation. Many of the large "flashes"—lakes formed by subsidence—were of this kind, and Bottom Flash at Winsford retains its trough-like form to this day (see Fig. 3). These deep troughs were frequently from a quarter to half a mile long, and originated under special circumstances. Where the brine pumping shafts were situated in nearly the same line, the solution valleys merged into one broad channel. If the overlying strata were tenacious the subterranean channel had time to become appreciably overdeepened before collapsing. Consequently when collapse eventually came there was a fall of considerable dimensions, such as occurred at Winsford in the eighteen-seventies when Bottom Flash was formed. A similar rapid subsidence took place along Bogart Brook (see Fig. 3) in 1879, when several small lakelets were formed overnight by the collapse of overlying strata into an overdeepened "solution-valley." Winsford provided perfect conditions for this type of subsidence, for the brine pumping shafts were concentrated in a narrow belt along the Weaver Valley. The fact that the flow of brine tended to take the line of least resistance in following the water courses, meant that subsidence was accompanied by inundation and complete dereliction of land.

Where a more diffuse pattern of brine pumping stations existed the second

[1] This fact was not readily accepted, especially by the salt manufacturers, who regarded subsidence as an "Act of God."

variant of the basic type occurred. This consisted of shallow troughs, the sides of which were not terraced, and occurred mainly in areas where the overlying strata were weak. The diffuse geographical distribution of pumping stations meant that the flow of brine was not concentrated in any single direction, and consequently the

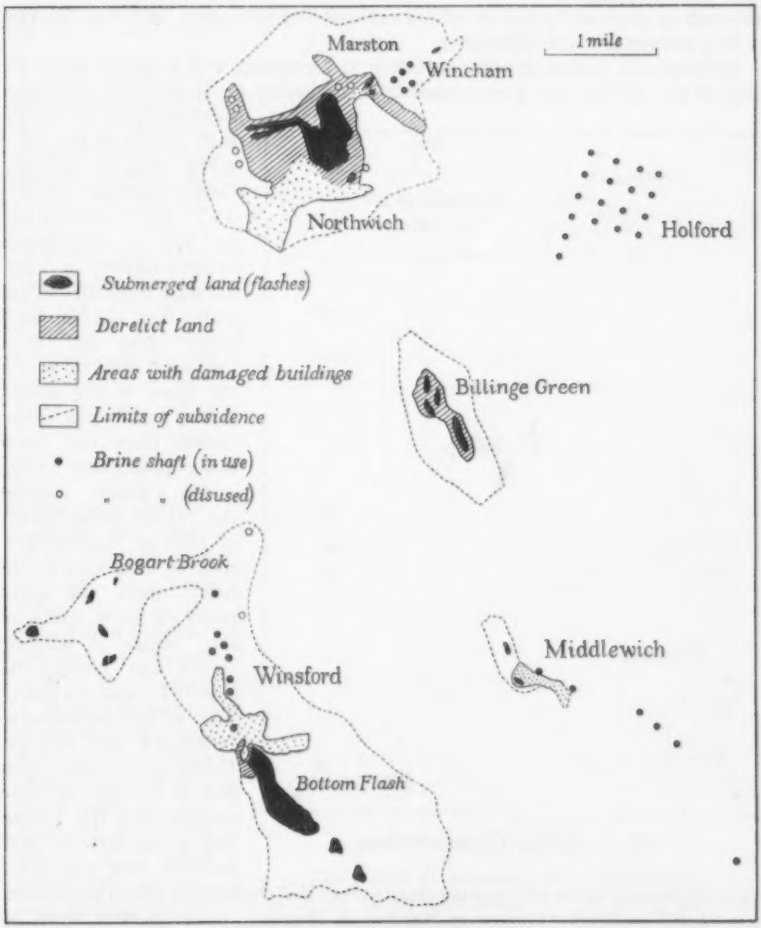



*Fig. 3. Subsidence in mid-Cheshire, 1954*

"solution-valleys" were never overdeepened. The weakness of the strata—normally composed of weak Marls overlain by thick glacial drift—meant that collapse was rapid. Small sink holes, some 20 feet across and a few feet deep, appeared shortly after pumping commenced. The collapse of these sink holes blocked the "solution-valley," and diverted it elsewhere, so that intermittent subsidence was experienced over a wide area. It was singularly unfortunate that this form of

subsidence took place mainly in the densely populated parts of central Northwich, where the weight of buildings and traffic hastened the impending collapse. The third type of trough-like subsidence, which was widespread in mid-Cheshire, consisted of shallow, barely perceptible hollows, which were formed at some distance from the pumping shafts. This type was less serious than those noted above, although its presence tended to inhibit expansion of settlement, as it was thought to be a portent of worse subsidence.

Although the decline in salt production at Northwich and Winsford after the turn of the century was accompanied by a slackening of natural-brine pumping subsidence, there was no such respite in the subsiding area at Billinge Green, between Northwich and Middlewich (see Fig. 3). Subsidence in open country at some distance from any brine pumping shafts had begun here in 1850. Opinions differed as to the cause of the subsidence, for it was equidistant from the three major productive areas, as Fig. 4 shows. During the "Great Subsidence" of 1881 at Northwich—referred to in some detail below—there was sympathy of water levels in the "flashes" at Billinge Green and Northwich. Sherlock noted the possibility of faulting between Northwich and Billinge Green bringing the Upper Bed of the latter in connection with the Lower Bed of the former,[1] and believed that the sympathy of water levels in 1881 was conclusive proof that the Billinge Green subsidence was caused by brine pumping at Northwich. However, since Sherlock wrote in 1921, the majority of the brine pumps at Northwich have ceased working, while those at Middlewich to the south have greatly increased their capacity. The continued expansion of subsidence at Billinge Green, and its appearance to the north of Middlewich itself (see Fig. 3), suggest that brine pumping at the latter town is responsible for this subsidence. Although the subsidence at Billinge Green occurs in a sparsely populated area it is none the less disruptive, for the subsiding area is traversed by both the Trent and Mersey Canal, and a branch railway (see Fig. 6).

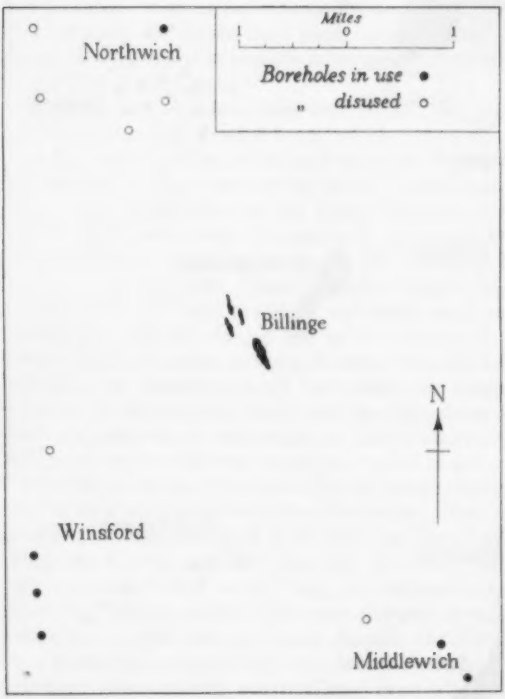



*Fig. 4. Billinge Green subsidence*

[1] Sherlock, *op. cit.*, page 64 and figure 3, page 28.

In 1873 the third phase of subsidence began at Northwich. This subsidence resulted from the practice of pumping "bastard-brine" [1] from the disused mine workings of Witton and Marston (see Fig. 5a), where it had lain for some thirty years or so. It was when supplies of natural-brine began to peter out elsewhere that the salt manufacturers turned to these great reservoirs of "bastard-brine." The subsidences which followed were the most spectacular and by far the most serious that had ever occurred, yet the salt manufacturers were never deterred from exploiting the reserves of "bastard-brine," despite the heavy toll exacted on property by subsidence. The first great collapse to result from the pumping of "bastard-brine" occurred at Marston in 1873. Here a group of flooded rockpits—as the rock-salt mines were known—were being pumped of their brine when the roof collapsed, letting the waters of a small stream into the disused workings. There was rapid solution of the rock-salt, and a lake 5 acres in extent, known as Neumann's Flash, was formed (see Fig. 5.). The flooded workings continued to be pumped of their brine, and by 1897 Neumann's Flash had an acreage

*Fig. 5. The growth of subsidence at Northwich 1877–1952. In 1952 the flashes were sealed off for use as lime waste reservoirs. Witton Flash to the west has been filled in this way. See also Figure 7*

[1] This was the commonly adopted term for brine which had lain in disused mine workings, as opposed to natural-brine, which was formed by the action of percolating rain-water on rock-salt.

three times as great as in 1877. Between 1897 and 1907 there was no great expansion, due to a lull in brine pumping. After 1911, however, when long-distance brine pumping to Weston Point [1] began, the "flash" continued to expand, until by the mid nineteen-thirties it was separated from Ashton's Flash to the south by a narrow cinder track only.

The area to the south of Neumann's Flash was dotted with isolated "rock-pit holes" in 1877. These marked the sites of former mineshafts, which had collapsed some forty years earlier, and had lain dormant until the eighteen-seventies when brine was first pumped from the disused workings. It was not until 1880 that subsidence of the kind previously experienced at Neumann's Flash occurred here, culminating in the "Great Subsidence" of 1880–1881, the like of which had never been seen before, and was never again repeated. The "Great Subsidence" began on 6 December 1880 when, after a premonitory rumbling, the ground above the disused mines began to heave and buckle. The water in the "rock-pit holes" began to boil and bubble, and was thrown violently above the surface. At every point of weakness in the overlying strata foul air was expelled from the mine workings, and where these jets of air encountered water in their upward path they spewed forth geysers of mud and sand, which spurted intermittently to a height of 12 feet. This turmoil died down after the first three or four hours, but minor outbursts occurred for two or three days afterwards.

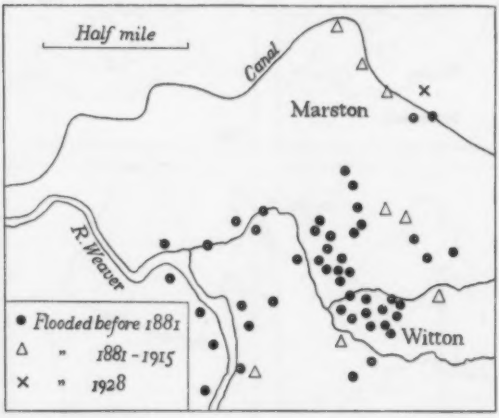



*Fig. 5a. Rock-salt mines at Northwich (after Calvert, op. cit.)*

The cause of the disturbance became readily apparent, for it was noted that the waters of Wincham Brook were flowing into the mines via a large rift in the strata, caused by earlier subsidence. The strong flow of water widened the rift, and subsequently it was noticed that the flow of the lower part of Wincham Brook had reversed, and as the day wore on the levels of Witton Flash and the River Weaver were lowered as the reversal of flow increased. Fortunately the gap was filled by debris from a 30-foot high geyser of mud and sand which heralded further subsidence. It has been estimated that during the twelve hours duration of the major subsidence the surface of Witton Flash and the River Weaver was lowered 1 foot over an area of 160 acres, and that not less than 600,000 tons of water flowed into the mine workings. The major subsidence was followed by other less serious sinkings throughout early 1881.

[1] Long distance pumping of brine in quantity was begun by the Salt Union to its plant at Weston Point, near Runcorn, in 1911. One of the Salt Union's principal aims in building the Weston Point Works had been the avoidance of areas threatened by damage from subsidence!

This catastrophic subsidence deterred neither the salt nor the alkali [1] manufacturers from pumping "bastard-brine," and as Figure 5 shows, subsidence continued to grow long after 1881. In 1893, and again in 1912, there were serious subsidences in this area, coupled with others in various parts of mid-Cheshire, caused by the then prevalent method of uncontrolled natural-brine pumping. However, with the decline of salt manufacture, which was especially rapid after 1911, and the depletion of most of the brine reserves possessed by the alkali industry, a new technique of brine pumping was introduced to the area.

Controlled pumping, as the new technique was known, had first been developed on the Fleetwood salt-field, and was introduced to mid-Cheshire by Brunner-Mond, the alkali manufacturers, in the early nineteen-twenties at Holford. The main object of the controlled pumping method was to obtain steady supplies of brine, without the attendant risks of subsidence. It could not be adopted successfully in areas already suffering from subsidence due to uncontrolled pumping, but it could prevent the occurrence of subsidence in newly developed brine-producing areas. In controlled pumping brine is produced by forcing water at high pressure down boreholes, where "the salt is dissolved by (the) water, and chambers, having limited and determinable dimensions are formed around each borehole." [2] The general consensus of opinion is that subsidence will not occur where controlled pumping is employed. As yet none has taken place on the Holford salt-field, and it is believed that any future subsidence would be slight and localized.[3] Contrary opinions do exist, and although it is not absolutely certain that Holford will remain subsidence free, the pessimistic views of certain authors cannot readily be accepted.[4]

Thus the history of subsidence has been traced from its small beginnings in the eighteenth century, through the turbulent eighteen-eighties, to the quiescent present. The face of large tracts of mid-Cheshire has been transformed by its ravages, and even where the land has not been submerged large areas are unsuitable for cultivation or building upon, because of the instability of the ground. Northwich in particular suffers from restrictions on the expansion of settlement enforced by the presence of large tracts of subsidence-ridden land in the vicinity of the town. Winsford, and to a lesser extent Middlewich, also finds its expansion hindered by the incursion of subsidence into the settled area. It is now proposed briefly to examine the effects of subsidence upon the pattern of settlement and industrial location.

The effect of subsidence upon the distribution of settlement in mid-Cheshire has been twofold. Firstly, the expansion of settlement in districts affected by subsidence has been severely curtailed; secondly, subsidence has caused the complete destruction of formerly populated areas. The pattern of settlement in Northwich has been greatly modified by both factors, for subsidence of a particularly destructive kind was experienced in the town during the latter half of the nineteenth century. The most densely populated part of Northwich lay on flood-plains of the Rivers Dane and Weaver, where the underlying strata were weak, and overlain with thick

[1] The principal alkali manufacturers were Brunner-Mond of Winnington, near Northwich. They manufactured alkali by the ammonia-soda process, which required large amounts of brine, most of which was derived at this time from the flooded mines.

[2] 'Merseyside—a scientific survey,' British Association, 1953, p. 253.

[3] ". . . the only possibility of subsidence is adjacent to the boreholes themselves"; I.C.I. Magazine, February 1952.

[4] Notably L. D. Stamp, 'The Land of Britain, its use and misuse,' 1950, p. 235. "The modern method of 'controlled pumping,' whilst it cannot prevent subsidence, at least exercises some control over the subsiding area."

glacial drift and alluvial deposits. As has been noted on pages 44–5, subsidence under such conditions was intermittent, yet widespread, and caused considerable damage to property. The Census Report of 1861 [1] notes that during the preceding intercensal period many people had migrated from central Northwich to neighbouring townships, as their homes were being "undermined by brine springs." It is apparent that the cause of subsidence was not yet understood, and the belief that it was a natural phenomenon was widely held.[2] The population of Northwich township had in fact been declining steadily since 1831–1841, a decade which had witnessed the beginnings of serious subsidence in the town itself. In the half century from 1851 to 1901 the population of Northwich fell from 1377 to 564, and although it is impossible to trace the decline further with accuracy,[3] it appears to have continued unchecked to the present day. Subsidence was also to blame for migration to areas free of subsidence within the neighbouring townships of Witton, Marston and Wincham during the late nineteenth, and early twentieth, centuries.

The principal effect of subsidence in Northwich has been the total incapacity of the town to expand northwards, where the growth of subsidence "flashes" has destroyed previous settlement, and allows of no other to take its place. Consequently the town has grown eccentrically about its centre, and this development has been accentuated by the impracticability of building upon the floodplains of the Weaver and the Dane to the south: Figure 6 shows this eccentric growth. Within the town centre the necessity of erecting subsidence-resistant buildings—built within a steel framework and capable of being restored to equilibrium bodily after sinking—has acted as a deterrent to the erection of new shops and similar facilities, owing to the relatively high cost of building. The eccentric development of settlement in the Northwich area, and the construction of large housing estates at some distance from the town centre,[4] has led to duplication of those facilities which tend to be found at the centre of a normally expanding town. Consequently the large outer suburbs—which have grown largely as a result of lack of building space in Northwich—rob the town of certain of its functions, and it is less well endowed than other towns of comparable size in Cheshire.[5]

Elsewhere in mid-Cheshire subsidence has not proved so great a barrier to expansion of settlement, nor has it been the cause of large scale migration. At Winsford subsidence was largely confined to the Weaver Valley, which was devoid of settlement owing to its liability to flood. There was slight migration from the town centre, which was affected by subsidence at the turn of the century, but damage from subsidence at Winsford has tended to avoid the densely populated areas. At Middlewich subsidence is confined to a small area on the northern fringe of the town, which has only recently become affected. Previously subsidence had been restricted to the uninhabited Dane Valley, and the sparsely inhabited area of Billinge Green.

[1] England and Wales, Registration Counties, Division VIII.

[2] This belief was widely supported by the salt manufacturers, who disowned their responsibility for subsidence. An interesting series of arguments for and against the contention is given by Calvert, *op. cit.*, page 363.

[3] Boundary changes make it impossible to trace decline accurately after 1901. Space does not allow of a fuller description of migration from subsidence affected areas.

[4] As Figure 6 shows, Cuddington, Barnton, Weaverham and Davenham form a semi-circle of outer suburbs at some distance from Northwich. Even the inner suburbs have a well-developed range of shops and other facilities.

[5] The author of 'A Plan for Cheshire,' in noting this disparity, believed it to be due to lack of population. However, the population of the Northwich area has greatly increased since 1946, without any attendant improvement in facilities.

Not only has subsidence exerted a strong influence over the distribution of settlement in mid-Cheshire, it has also dominated the siting of industry, particularly salt manufacture, since the mid-nineteenth century. Subsidence caused especially severe damage to the salt-works at Northwich during the early and mid-nineteenth centuries, causing their migration to sites near by at Wincham, Marston and Anderton (see Fig. 7). Eventually the expansion of subsidence caused further damage at these new sites, and by the early nineteen-twenties the salt industry was almost defunct in the Northwich area. Subsidence was not the

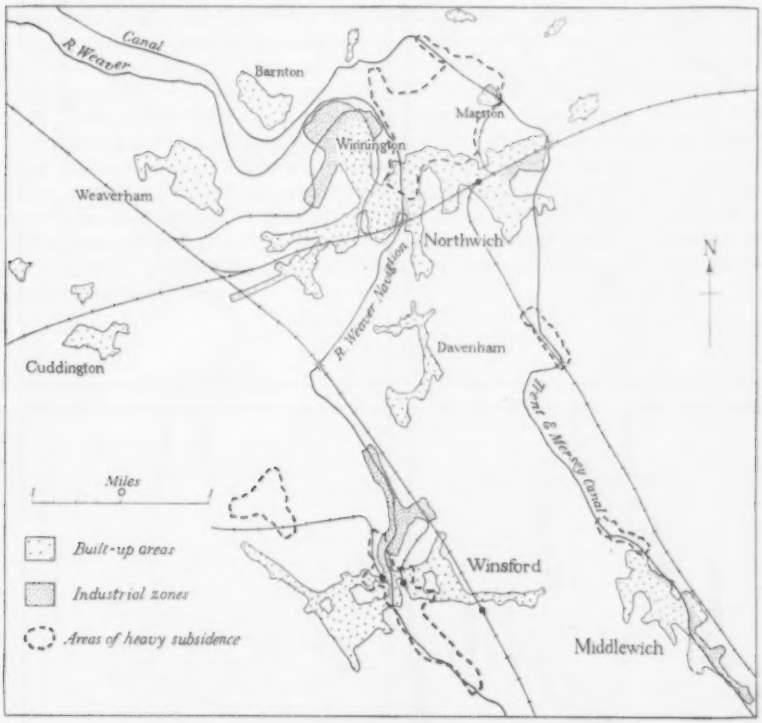



*Fig. 6. Mid-Cheshire settlement and communications*

only cause of this decline, for several other geographical and economic factors were also responsible, but it would appear that subsidence, by robbing the industry of the best sites along the Weaver Valley and destroying many other salt-works, appreciably hastened the industry's decline. At Winsford subsidence was less to blame for the industry's decline than other factors, but it must be remembered that the severest blow to the industry's prosperity in mid-Cheshire—the Salt Union's decision to manufacture salt at Weston Point—stemmed from the desire to erect costly modern plant on subsidence-free land.

Subsidence has not always been a negative force in industrial location, however. The early growth of the chemical industry at Winnington, near Northwich (see

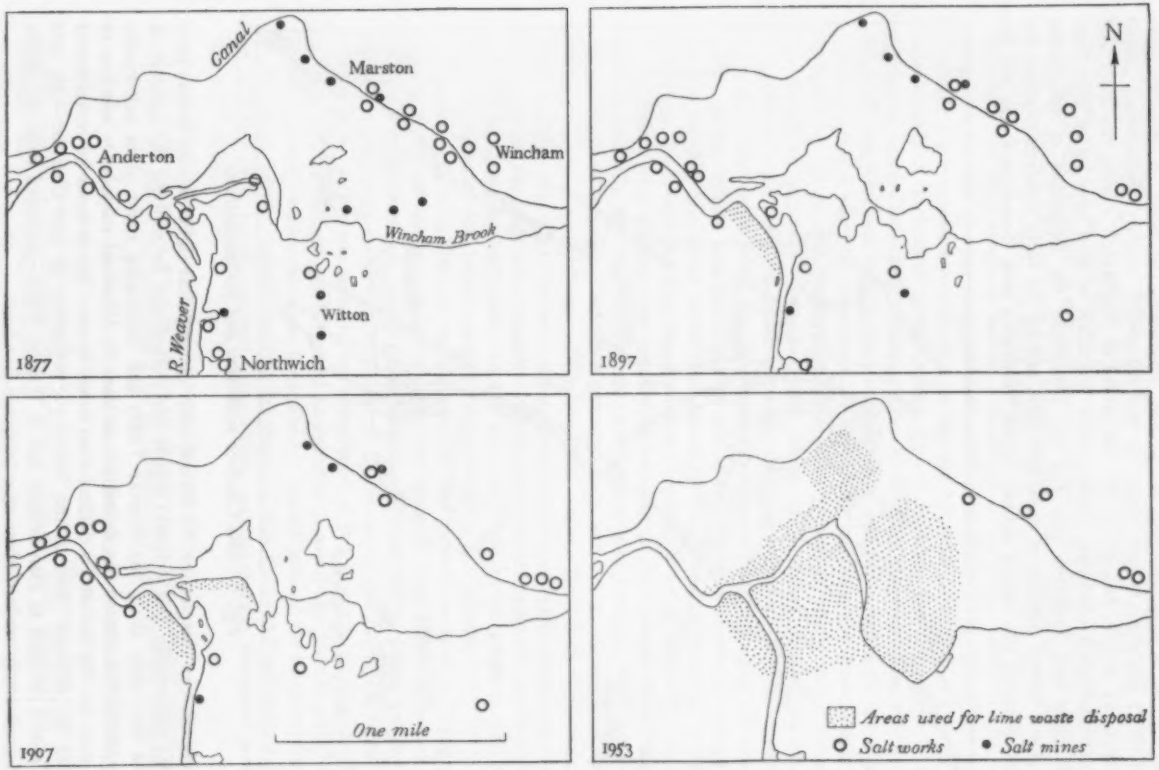



*Fig. 7. Salt works at Northwich*

Fig. 6), where alkali is manufactured by the ammonia-soda process, gained great impetus from the proximity of cheap, derelict land, upon which liquid effluent could easily be disposed of. Winnington's undoubted advantage over the many alkali works which were built in mid-Cheshire during the eighteen-eighties was the ease of disposal of the large amounts of waste lime which were left by the ammonia-soda process. Today virtually the whole of the subsidence-ridden area to the north of Northwich has been embanked, and is used as a lime-waste reservoir (see Fig. 5).

Despite its value to the chemical industry—especially during its early development—subsidence can hardly be described a mixed blessing. The large scale destruction of property, the disruption of communications and the dislocation of the salt industry by subsidence, all appear to outweigh the advantages enjoyed by the chemical industry from the proximity of derelict land suitable for waste disposal. Fortunately, subsidence is no longer virulent in Northwich, although its long term effects—notably the difficulty of building on subsidence affected land—must inevitably impair the town's prospects of improving its status. Elsewhere in mid-Cheshire subsidence is a less serious problem, yet it is capable of hindering expansion of settlement and industry, and making costly alternatives necessary. Subsidence has been, and remains, a most important factor in the development of mid-Cheshire, yet despite its depredations the area has prospered, and seems likely to continue doing so.

# A PEASANT ECONOMY IN NORTH-WEST PORTUGAL

R. D. HAYES

DURING THE Long Vacation of 1954 a party of six Cambridge University students set out to make a study of the rural peasant economy in the Minho Province of Portugal; the party consisted of R. D. Hayes (St. John's College), P. Haggett, J. B.

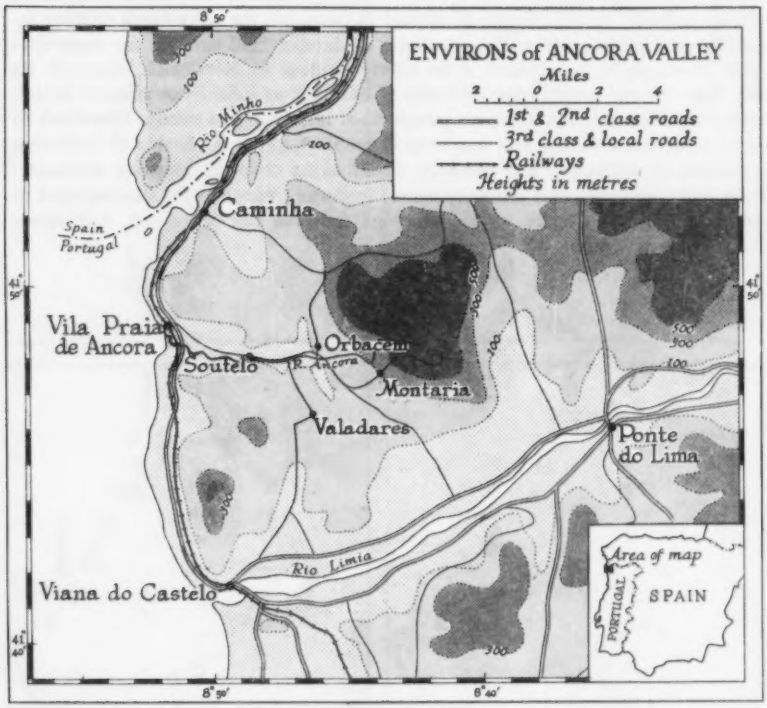



*Figure 1*

Neilson, N. J. Spearing (St. Catharine's College), A. J. Spivey (Cheshunt College,) P. A. Colinvaux (Jesus College). The results of the expedition are embodied in this paper, which aims at describing the economy of a small part of the Minho as it exists today, indicating the forces responsible for past changes and those likely to cause changes in the near future. The area chosen for study was the Âncora Valley (Fig. 1), and the problems which emerge are viewed mainly from the local standpoint. Other aspects of the party's work have been touched upon only in as much as they place these local problems in their national context. They concern the significance of the Minho in modern Portugal and, since the Minho is the traditional

source of emigrants, demand careful examination of government emigration policy particularly in relation to the development of the Overseas Provinces.

## THE REGIONAL SETTING

The Minho Province is in the extreme north-west of Portugal and its modern capital is Braga. Within the Province is the town of Guimarães which was the capital of Portugal in the twelfth century and is traditionally regarded as the cradle of the nation. The historical background of the Minho as the old core area of the Portuguese nation is reflected in the present dense population of the rural peasantry [1] but both the economic and political centres of gravity of Portugal have now moved south leaving the Minho rather cut off and backward. With a continuing very high birthrate there is an increasing pressure of population which the longstanding tradition of emigration only partially relieves.[2] The distinctive feature of migration among the Minhoto is the high proportion of unaccompanied males who migrate, intending to return to their homes and families after a period of work in Lisbon, Brazil or elsewhere overseas. The birth-rate remains high in spite of this.

In the Minho the granitic core rocks of Iberia are exposed and throughout northern and central Portugal these contain widespread deposits of non-ferrous metal ores, particularly tin and wolfram. Since there is only a small home market, economic production is marginal and production is often only profitable when war upsets the normal supplies to Europe. The main rivers which flow roughly east–west are entrenched in narrow valleys. The dissected relief hampers regional and local communications, particularly as the rivers themselves are of little value for transport. Hydro-electric power potential is some compensation. The coast is abrupt; although there is a narrow coastal plain the hills rise steeply behind, so that at the head of the Âncora Valley the principal height reaches over 2500 feet at a distance of only 10 miles from the coast (Fig. 1).

With a latitude almost exactly comparable with that of Rome the climate of the Âncora valley (lat. 41° 49′ N.; long. 8° 52′ W.) has a basically Mediterranean rhythm although in detail the Atlantic coast location has a strong modifying influence.[3] The critical feature of the climate from the economic point of view is the low rainfall during June, July and August when the maize crop is maturing. It is rare for as much as a tenth of the annual rainfall to fall during these three months. Although the area is well watered compared with the rest of Portugal, it is dependent upon irrigation for its summer agriculture. Both the need for irrigation of crops and the limited amount of flat land available have led to terrace cultivation to provide for the rising population, but the possibilities for further expansion of terracing are now very small.

## SURVEY METHODS

In making our detailed field study of the basin of the Rio Âncora four main methods of investigation were used.

1. *Cartography.*—(*a*) Surveys were made on a scale of 1/500 of 5 areas of farmland of about 6 acres each, selected to illustrate important points in the valley

[1] Birot, P. 'Le Portugal,' Paris, 1950, p. 71 gives an average density of 400 persons per square kilometre of cultivated land in the Minho. Our own computation for the area of our study was 460 persons.

[2] The excess of births over deaths for the Minho in 1953 was 18 per thousand (based upon crude birthrate). Comparable figures are France 8, Belgium 4·5 and the whole of Portugal 12 per thousand.

[3] Temperature: Sea level monthly average 46° F. January, 64° F. July. Rainfall: Average annual on coast 50 inches, rising to 100 inches on hill slopes a few miles inland.

economy. (*b*) For a more general picture a land use map was compiled for the whole valley based on the Portuguese 1/25,000 map.

2. *Questionnaire.*—An eighty-point questionnaire was devised and was completed by a landholder for each of the five survey areas. Points covered were age and nature of buildings, regime and marketing of crops, construction of terraces and soil improvement, availability and use of water, farm implements, emigration and the structure of the labour force, extent of animal husbandry, methods of transport open to the peasant, origin and terms of tenure of the holding, possession of woodland, and the place of money in the farm economy. A check on this narrow sample was provided by a ten-point questionnaire put to all householders in the village of Orbacem where questioning was limited to source of income, frequency of migration, types of land tenure, occupation and numbers of stock.

3. *Interviews.*—We had interviews and informal contacts with people of the valley, the peasants, craftsmen, tradesmen, priests and local officials. Much of the background material of the study was built up in friendly conversation with the local people.

4. *General.*—Critical correlation of detailed data gained through field work with generalizations in current literature. Outside the valley information was gained from conversations with Portuguese geographers, study of theses on topics similar to our own, examination of statistical records, and interviews with district and national administrators culminating in an interview with Dr. Salazar, the Prime Minister.

## THE GENERAL PICTURE OF THE VALLEY

The fundamental feature of the economy of the Âncora area is the near subsistence peasant agriculture and its associated crafts. Apart from some processing industries and a small tourist trade, both confined to the coastal fringe, the prosperity of the area depends upon the prosperity of the peasantry. This close attachment to the land may be seen in the table summarizing the results of the Orbacem census (Fig. 2). The data in this table are derived from the 10-point questionnaire put to the village on 6 September 1954. Orbacem is one of the less cut-off villages in the valley. The table shows the close link which all households have with the land and the comparative rarity of cash payment for agricultural labour. It contrasts occupation in the traditional rural crafts—carpenter, smith, mason, baker; with work in industry of new development—in this instance, a furniture factory and the forestry service. Home spinning and weaving of wool and flax is shown to be active. The incidence of migration is partially indicated, but a more detailed breakdown is given in the table on page 68.

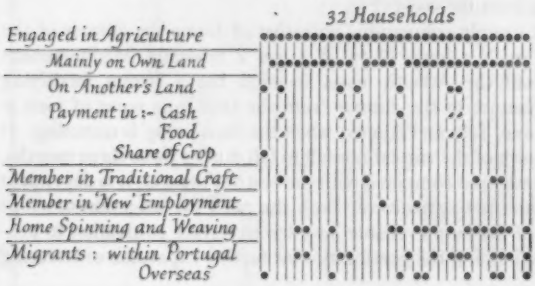



*Figure 2*

The coastal section of the valley is broad but narrows very rapidly at a point about 3 miles inland (Fig. 3). From this point up river the character of the valley

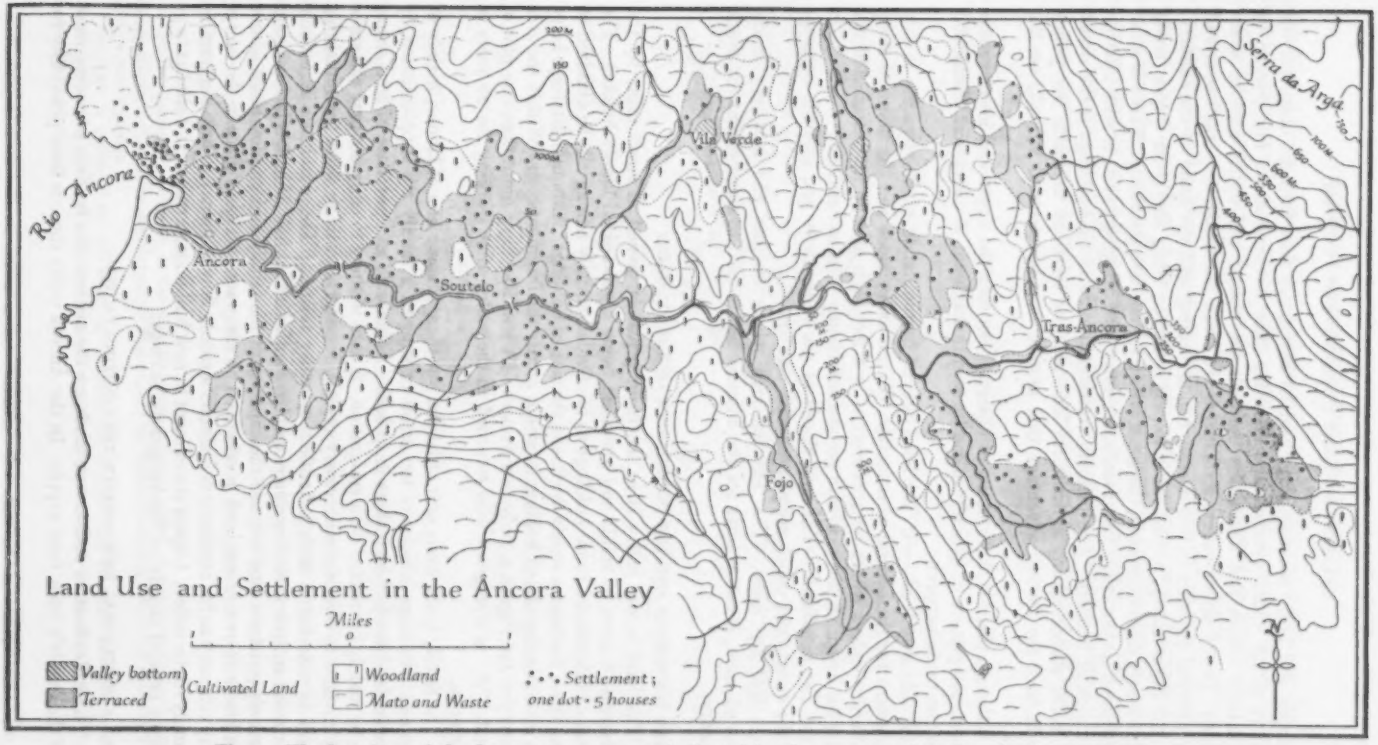



*Fig. 3. The locations of the five survey areas are indicated by the names used to describe them in the text*

changes and both the main river and its tributaries flow through deep, narrow valleys which widen occasionally, affording sites for settlement. The pattern of settlement shows this distinction between the coastal and upper sections quite clearly. In the upper valley, settlements are small but moderately nucleated, and are grouped together in two narrow bands running *with* the grain of the country. In the lower valley, settlement is loosely scattered along the lower slopes, being particularly concentrated on the spurs which jut out into the valley. There is some settlement on the valley floor associated either with bridging points or with infertile outcrops of bedrock. The primary consideration in siting buildings is the desire to avoid alienating any agricultural land and the locations to which this policy leads have the further advantage that granite may be quarried virtually on the site.

Although there is the contrast of character between the upper and lower valleys a common pattern of agriculture can be seen throughout. A convenient distinction may be made between:

(*a*) *The crop lands.*—(i) The level alluvial bottom lands where terracing is only necessary for the control of irrigation, (ii) the valley sides and the floors of steep tributary valleys where terraces from 4 to 8 feet high have to be constructed not only for irrigation but to obtain ground sufficiently level to cultivate.

(*b*) *The woodlands.*—The mid slopes of the valley sides and infertile outcrops of the valley floor which are planted with conifers.

(*c*) *Hill top* mato.—The hill top area where heather and bracken, locally termed *mato*, is cut as litter for the animals and is used to some extent for rough grazing.

### LAND OWNERSHIP AND THE SIGNIFICANCE OF THE EMIGRANT

The land in the valley is in the main privately owned in small units by the peasants, 6 acres of arable and grassland being a good-sized family holding. The laws of inheritance cause holdings to be divided equally among all the children so that there has been a steady decline in the size of holdings. Although marriage helps to maintain the size of holding it cannot rectify the fragmentation. Within the area surveyed for Figure 4, only two owners—(A and B)—have more than one plot of land. "A" is a migrant who returned to the valley after working for 20 years in America.

The family is the basic unit of labour but there is some hire of labour, mainly of women. Holdings which are too small to support a family are supplemented by rented land worked on a share crop basis. Actual sale and purchase of land seems to be mainly connected with emigration. A man wishing to emigrate may sell some of his land to obtain the necessary capital, leaving his wife to work the remaining land in association with a brother or other relation. The purchaser is often a returned emigrant, for few others will have sufficient capital. If he has large savings he may purchase land beyond the capacity of his family and employ hired labour on his fields or rent out land to others. The emigrant also has a place in the every-day economy as his remittances maintain a steady flow of money to help support his family in the valley. Capital investment in new buildings, terraces, and similar large items depend largely on the emigrants' savings.

### THE AGRICULTURAL BASE—WATER THE LIMITING FACTOR

The valley bottom and terrace lands are the nucleus of a holding providing most of the family's basic food supply. In the Âncora valley there is little possibility for

expansion of this acreage but it was stressed by all the farmers questioned that if they had more water they could either extend their maize acreage or get a better yield from their present land. The use of water for irrigation is restricted from June 24 to September 29.[1] The irrigation is based upon spring supply controlled through granite tanks, or on water diverted from the rivers by damming and channelling. In the coastal part of the valley much of the alluvial land is irrigated by bucket chain from wells 10 to 20 feet deep, elsewhere the granitic structure gives an unpredictable water table and well sinking is not practicable. A few motor pumps have now been installed by the wealthier peasants to lift water direct from the river on to adjacent terraces but their use is controlled both by cost and by strict

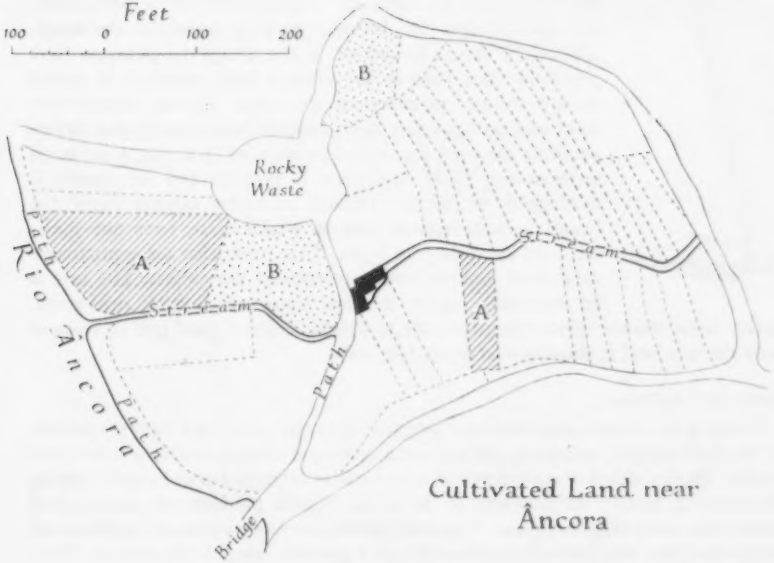



*Figure* 4

licensing. The available water is so fully used that the installation of new irrigation systems is very difficult.

The soils are medium to light loams becoming lighter towards the bottom of the slopes and on the riverside flats. They have a moderate crumb structure which is maintained by frequent hand cultivation and water passage is very free, a point of great importance on irrigated lands. Seaweed and litter from the farm yards are the only sources of organic material; as one moves inland the use of seaweed declines rapidly.[2]

[1] On the property surveyed at Soutelo the farmer had a right to water from a stream on one day in eighteen, he supplemented this supply by direct pumping from the main river using a motor pump.

[2] Seaweed is gathered on the coast by women. An ox-cart load of dried seaweed costs about 120 escudos (30*s*) and takes one person about a week to collect. November is the main month for collection.

Although little deliberate action is taken to restore them, most mineral nutrients remain at a moderately high level under crops, possibly because the irrigation water has a high mineral content. However, the calcium level is undesirably low for good agriculture and although there is no sign of deficiency disease, only crops tolerant of a low calcium level are grown.

Constant attention by hand while the crop is growing is the dominant feature of all cultivation. The size of plots, the distance between them and the steep terracing all militate against the use of large implements in cultivation. A large number of peasants have a share in the steeply terraced land at Tras-Âncora, shown in Figure 6. The terraces are of particularly fine construction and are uncommonly broad for the steepness of the slope. Elsewhere in the valley the peasants have generally been content to create a large number of rather narrow terraces to overcome the slope. On the broader terraces and on the valley floor, ploughs made locally and drawn by cattle are used for the preparation of land. On some small terraces only hand cultivation is possible and the *enxada* is universally employed. Peasant transport centres upon the heavy wooden bullock cart of which there were 700 registered in the valley in 1950. This represents an approximate average of one per twelve persons in the valley. The cart is of extremely robust wooden construction with steel-tyred, nearly solid wheels. Even when the cart is heavily laden a good pair of cows or bullocks can haul it steadily over steep hill paths.

CROPS AND ANIMALS

Maize is the predominant summer irrigated crop and provides a high proportion of the food supply: marrows, cabbages and beans are often intercropped with the maize. Small patches of onions, potatoes and coarse cabbage are maintained during the summer, usually on plots near to the house, but the predominant pattern is of maize with some irrigated grass. Vines are grown over courtyards and pathways or supported from the front of terraces with grass growing beneath the canopy. They are rarely allowed to compete for land which could be used for other crops (Figs. 5 and 7). The wine is "green." or unmatured, but it has a ready sale both in Portugal and Brazil. It is a source of cash income to the peasant.

There is a wider range of winter crops with greater variation from farmer to farmer. Rye, potatoes, and oats are the most important crops grown by quantity, but vegetables are also grown and are vital to the peasants' diet. Some terraces are sown to grass and yield hay for cattle food. Among minor crops which ripen at various times of the year are the olive, which is grown universally, and soft and citrus fruits. Little use is made of fruit except for home consumption and some cider-making, although a small quantity is sold in the local shops.

The cattle of the valley are mainly cows which are able to combine the functions of draught, milk and stock animals. Lack of summer feed is critical and irrigated grass hand-cut and stall-fed, has to be supplemented by the tops cut from maize just before it ripens and coarse roadside grazing. Although most of these animals are of a multi-purpose breed, under Government encouragement there has been some trend towards the Turino (basically Fresian) for milk production. On account

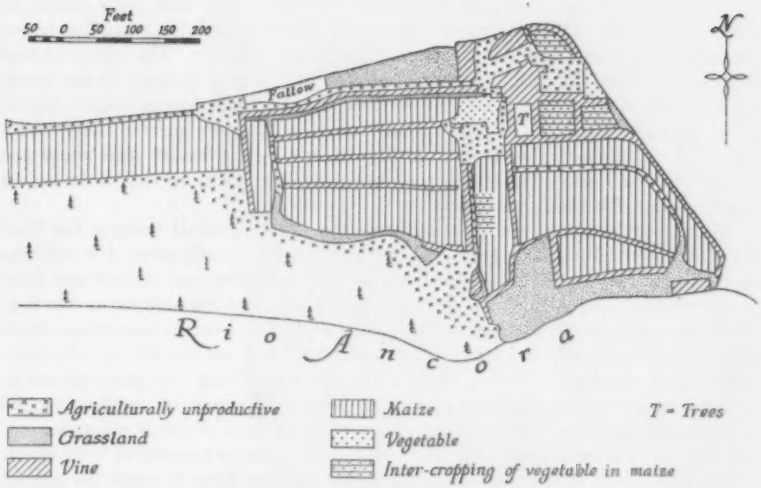



*Fig. 5. Land use at Soutelo*

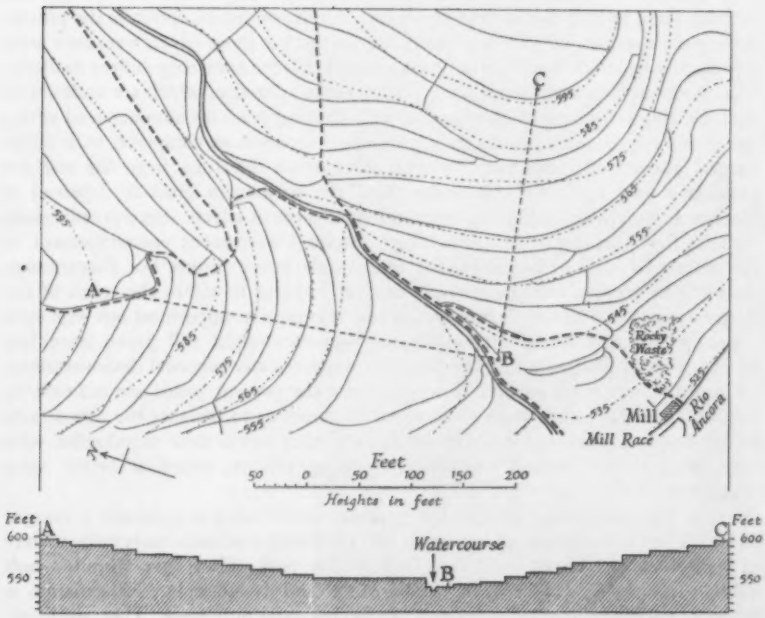



*Fig. 6. Steeply terraced land on the property surveyed at Tras-Âncora*

of the poor feed and strenuous life of these beasts a high milk yield cannot be expected, and the valley butter and cheese factory (established 1894 and a flourishing business) has to rely upon a great number of small producers. The killing of beef animals at a very young age is also linked with the shortage of feed. In the upper valley sheep and goats are run on the Serra da Arga and the adjacent heights. Lower down the valley sheep are only kept in ones and twos. Pigs are generally kept within the yard and are not of very good quality, but the butter factory rears about 240 mainly on the waste from butter and cheese-making. Hens scratch a precarious living around the houses and yards.

Apart from the cultivated terrace lands the usual balanced holding has both woodland and hilltop *mato* (Fig. 3). The woodland is usually planted to conifers and a few eucalyptus. The conifers yield a cash income by sale of resin and there is an arrangement by which the peasants tap resin on Government trees. Much of the timber goes for pit wood or pulp. The eucalyptus is a recent innovation which here matures at nearly twice the speed of a conifer and has the further advantage that it will regenerate from a stump—this saves grubbing out and replanting. These characteristics commend it to the peasant. Planting of conifers by the Government forest service is progressing rapidly on land which is otherwise unproductive. The *mato* land is used for rough grazing and is a source of litter which is laid down both inside the yards, and in the adjacent lanes to catch the animal droppings which are an important source of organic manure.

### CROP IMPROVEMENT

Although the cattle are by no means free of tuberculosis most of the crops and animals seem to keep fairly clear of disease. An important exception is the potato; during the summer only a few potatoes are grown, but those which were seen were crippled by Colorado Beetle, and we understand that the main crop suffers similarly. The marginal nature of the economy leads to many practices which are undesirable both for the well-being of crops and of soil. Cutting grass for summer feed with a small saw-edged sickle results in a poor sod formation as compared with either natural grazing or more even mowing. Also, since the dung from the stall-fed animals is only applied to the arable land the permanent grass is deprived of manure although winter grazing helps to reduce these ill-effects. Seed is universally derived from the previous year's crop despite Government encouragement to use improved strains. Similarly, the land needs heavy liming but Government attempts to provide cheap lime have not yet brought it within the reach of the Âncora peasant. The simple question of cost is at present uppermost but with such a poorly educated community apathy or prejudice might still prove stumbling blocks. It is unfortunate that the peasant cannot see any practical demonstrations of improved practices locally. However, since the present yields are reduced by lack of water there does seem to be room for doubt as to whether the new strains would give their expected yields in the Âncora valley unless their introduction were accompanied by a general reorganization of agriculture, aimed at better water utilization.

From this agricultural activity the peasants derive what is generally a meagre living. Their diet is based upon a maize and rye bread, rice and a stew made mainly of vegetables with either dried cod, fresh fish or pork. They have a limited cash income from sales of wine, resin, timber, milk and livestock, but little margin is left after paying their small taxes and making essential purchases. They are, however, of a very cheerful disposition, and despite the widespread male emigration,

Roadhead
¼ ml.
Small house
on boundary
Orchard
Gate
Vine canopy
on granite supports
Boundary
Poorer type of
peasant house
Drinking water

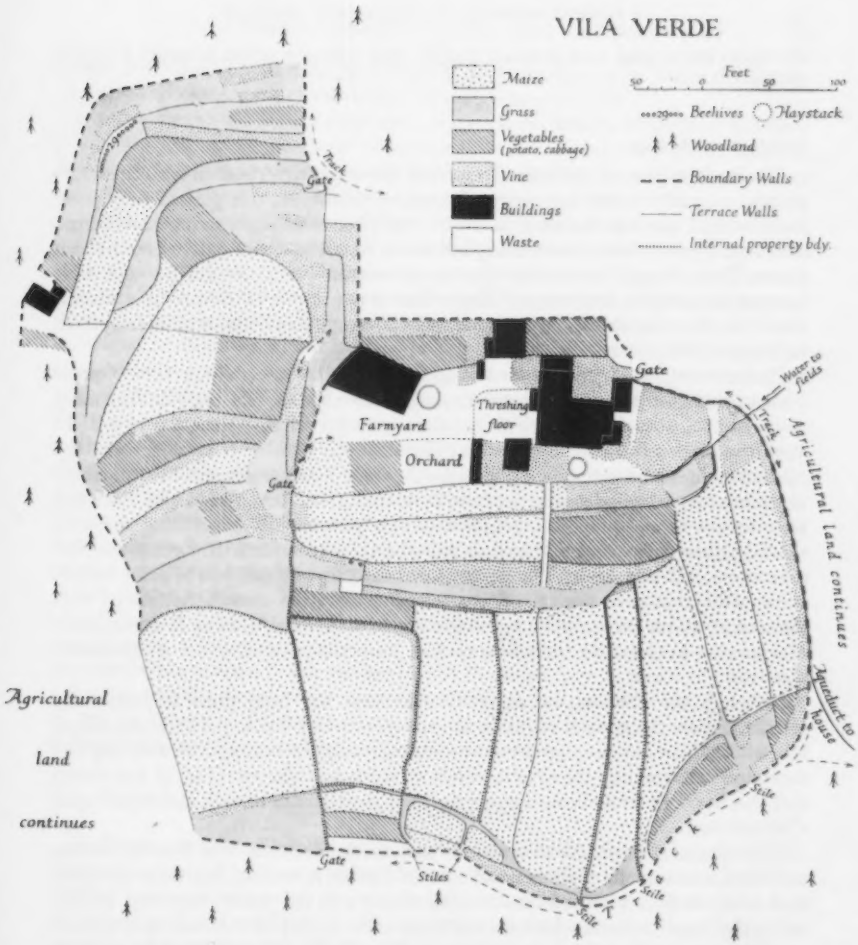



*Fig. 7. This property is a prosperous one and, unlike the majority in the valley, has an adequate supply of water. The land is worked as a unit although the ownership is divided. The farmer has other land of his own elsewhere in the valley but lets it out on a share crop basis. Besides cropland, the property has woodland and* mato *on the valley sides. Individual fruit and olive trees have been omitted from the map but may be seen on the photograph. They are particularly numerous on the protuding tongue of rising ground. The stock consists of 6 cows, 2 bullocks, 2 pigs and some poultry. Five people are regularly employed. Apart from milk sold to the butter factory at Vila Praia de Âncora there is no regular sale of produce, although some maize, beef, wine and honey are sold where surpluses occur. The widespread use of granite in the aqueduct, vine support posts and buildings is characteristic of the district. Note, right foreground, the poorer type of peasant house. The road head just over the hill behind the house is recent and not often used for the business of the property, except by the farmer on his bicycle. Milk and other produce is sent down a two mile bullock track route direct to the main valley road.*

the valley has a good deal of social stability and cohesion which it would be tragic to lose.

FACTORS OF CHANGE

The basic pattern of rural life received its last major modification with the introduction of maize in the late sixteenth century. However, this pattern now exists in a Portugal which is changing radically. The planned changes in national life run concurrently with other modernizing influences which have now entered the peasant scene. These began in the late nineteenth century with the railway and have increased steadily in importance. Their effect is impossible to measure in statistical terms but their results can be observed in local variations of economic development and way of life.

Predominant among the modernizing influences are the railway from Oporto built in 1878, the butter and cheese factory, established at Vila Praia de Âncora in 1894, and the road network which has developed particularly since the 1930's. In 1935 the National Forest Service was founded and besides extending woodland plantations has built a significant mileage of roads. The government have in recent years attempted to improve agriculture by research into better seed and stock and have sought to encourage the adoption of new practices by advertising and subsidized prices. Increasing emphasis is being placed upon elementary education, but illiteracy is still very high. The wartime demand for wolfram was of some benefit to the valley but with the end of the war all activity has ceased. Associated with these changes has been a limited growth of opportunity for paid employment, some of a permanent character and some, such as road construction, of a less permanent character.

Although the influence of these developments has been great in some very restricted cases the general effect on the valley economy has as yet been superficial for, whilst there has been an increase in opportunity for non-agricultural employment and cash trading, the census which we made at Orbacem (Fig. 2) has shown that this has only rarely broken down the basic dependence of each individual upon a plot of land.

The value of the rail link to the butter and cheese factory at Vila Praia de Âncora and for the movement of timber to Viana do Castelo is evident, but these activities themselves have not caused fundamental changes in the valley economy. In the valley the rural craftsmen have varied their trade a little in the face of imported goods but they still retain their position in the agricultural community by exercise of their traditional skills. Of the roads one notices the very marked contrast between the surface of the network built during the last fifty years and of the bullock tracks which feed into them. These tracks often have exceptionally severe gradients and are rutted, in rock, to a depth of 18 inches. The results of this situation are that while lorries can carry such commodities as fish, timber and milk quickly up or down the valley, the essential integration of the valley settlements, which for the most part lie slightly off the roads, is dependent upon human portage and the bullock cart. Although on the main valley and coast roads animal traffic declined by two-thirds between 1937 and 1950 [1] bullock carts licensed for use on roads still outnumbered mechanical vehicles in the valley by twenty to one in 1953.[2] Despite

[1] Junta Autonoma de Estradas—Estatistica de Transito 1937–8 and 1949–50. Special traffic censusus.

[2] Camara Municipal Caminha—Licence Records 1953.

a twice daily bus service running from Vila Praia de Âncora to Viana do Castelo via an inland route, most of the valley traffic continues on foot.

Opportunities for full time wage earning are a novel feature to the local economy but in terms of actual numbers the openings have not been very great. Most of this development is near Vila Praia de Âncora where in 1954 a total of 147 workers were employed out of a population of 3700. Of these 75 were in the timber mills, 12 at the butter factory, 49 in building and 11 in furniture making. The mineral industry is classified as "inactive." To these figures must be added the people who work during the summer in the tourist trade and also the 170 "deep sea" fishermen who sail in the cod schooners from more southerly ports but who live and spend their considerable earnings in Vila Praia de Âncora.

Neither in the Âncora, nor in the Minho generally, is it reasonable to consider emigration as a very potent factor of change in itself for it has been an accepted part of the peasant way of life for several centuries. However during this century there have been wide fluctuations in numbers emigrating each year. These short term fluctuations have been further accentuated by world economic conditions which affected the value of remittances home. The longer term change is that the Government are now seeking to finance permanent migration of entire families to Portuguese Overseas Provinces where they will be settled in planned colonization areas. Although at present only small in volume, this type of movement constitutes a potential factor of change in the Minho generally.

The degree to which the changes mentioned may be said to have had effect can best be seen by comparison of some of the lower valley settlements with more remote settlements in the upper valley like Tras-Âncora. Although in the former the subsistence pattern is still not broken, in the latter there is noticeably less cash influence and the people have a smaller share in the generally rising standard of life in Portugal. Particular mention was made in the upper valley of the difficulties in obtaining medical and veterinary services.

## PROBLEMS EMERGING

In looking to the future and examining the problems which emerge from this study it is essential to bear in mind that the Âncora valley (in common with the Minho) is in general a happy community which has both social and, so far as can be judged, political stability. Dr. Salazar, who has for some time been facing the problem of integrating the Minho with general plans for development in Metropolitan and Overseas Portugal, has already emphasized that he does not favour any action that would tend to disrupt the social pattern. Whilst giving this point every consideration, however, it must be acknowledged that this stability is being undermined by those factors of change just mentioned. The trends towards a money economy, better education, and the inereasing differential between the standard of living of the rural peasantry and that of urban workers all mean that the present stability cannot be regarded as permanent. Just as programmes of medical improvement in tropical countries prove socially unsuccessful unless economic plans are implemented simultaneously to provide for the increased population, so better education may worsen the position in the Âncora area unless economic plans are matched to it.

There are two aspects to the solution of these problems, one is to attempt the greatest possible improvement of the existing pattern of life, the other is radical reorganization related to the available resources. In view of both the dense

population and the high birth-rate these solutions find common ground in the need for emigration.

Figure 8 shows the percentage increase of population in five European countries. It is from the Recenseamento Geral da População 1950, and points to the rapid

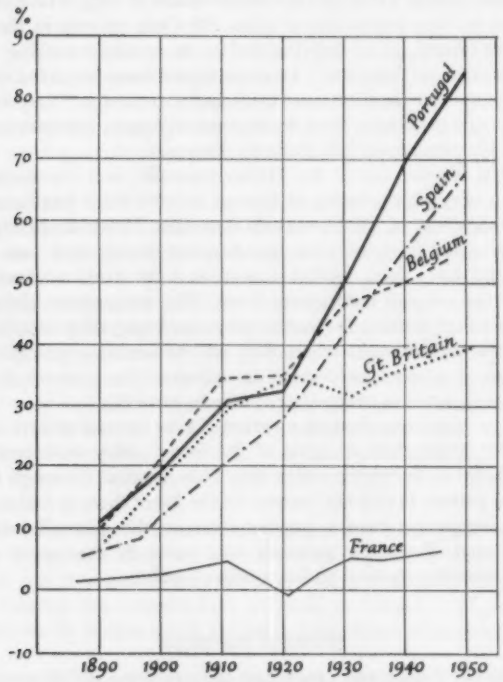



*Figure 8. Increases of population*

and continuing growth of population in Portugal. The Minho province has a rate of population growth well in advance of this national average.

### THE WATER PROBLEM

The availability of irrigation water in the summer months is the dominant problem of Âncora agriculture. Its immediate effects are apparent in limiting the area of land which can be used for the irrigated maize crop; its repercussions extend into the field of the population/resource balance throughout the Minho. The expansion of water storage facilities to increase the amount available in the summer months is hampered by lack of capital. Peasant ingenuity has pushed the small scale schemes to their limit and even if government-backed large scale schemes were introduced, they would raise further problems by flooding productive land and consequently displacing peasant families.

The possibility of using the present water supply to greater advantage is more hopeful. The summer maize acreage is mainly for human consumption and it is suggested that some attempt might be made to throw greater reliance on winter

non-irrigated crops (e.g. the potato, if its pests can be controlled satisfactorily). In summer more intensive cultivation of improved strains of maize on a reduced acreage of land, and the substitution of fodder crops on the released land, would loosen the limitation on cattle rearing and improve the possibilities for dairy production from the Âncora valley. It is anticipated that better utilization of the available water will be achieved by concentrating higher yielding strains of maize on to a smaller acreage of land enabling the maize production to be maintained while fodder acreages are being expanded. The greater availability of manure and the increased cash income from dairying would justify the cost of better seed and lime. By eliminating the critical period of restricted cattle feed the way is open to take advantage of the unused dairying potential of the rest of the year. The facilities for marketing already exist in the valley, and markets for the produce will increase steadily with the rise in the standard of living.

## POPULATION AND RESOURCE

Taking the wider view, the valley's agricultural problem is part of the overall problem facing the Minho. This is a very dense, predominantly rural, population living by a subsistence agricultural economy. Proposals for the Âncora valley must be viewed within the need to widen the use of the Minho's resources. These are an unskilled labour pool and, compared with the rest of Portugal, a moist equable climate (although one with the limitation of a summer drought). At present the severely limited area of cultivable land is fully occupied in supporting the families who farm it. Any major shift towards agriculture for market, or dairying, would therefore involve redistribution of population. Developments moulded on the Minho's natural advantages present a paradox for while increased stock and forestry are reasonable responses to the physical resources, both are low labour employers and intensify the employment problem. Industrialization in the Minho provides no very hopeful prospects of absorbing a displaced surplus as the overall rate of industrialization in Portugal is low and, apart from its labour, the Minho offers few attractions as compared with the pull of Oporto and Lisbon.

It is density of population above all else which presents the problem, current emigration is barely maintaining the *status quo* for the birth-rate remains high in spite of extensive male migration. This high birth-rate is the dynamic element in the problem and the population cannot be reduced unless emigration removes the whole family permanently from the Minho. In so far as future plans embody the idea of reducing the population rather than encouraging the present habit of long term "going away to work," they hinge upon the development of the Overseas Provinces particularly Angola and Mozambique. Dr. Salazar having in mind the need of these countries for population does not wish to see entire families emigrating to foreign countries and thus "lost" to Portugal. Settlement in the Overseas Provinces, however, in prepared colonization areas, is costly and Portugal has many demands upon her limited capital. Even with sufficient capital available the rate of safe absorption of settlers in the new territories might set a severe limit upon the speed of transfer and unless the movement can be speeded in the near future there is a danger that some of Portugal's scarce capital will have to be diverted to unprofitable subsidy in the Minho. The safety valve in the event of difficulty would be to facilitate family migration to foreign countries.

The working out of these wider elements of the problem are essential before an understanding of the Minho's future can be obtained. In presenting this paper, which has primarily related to one very local situation in the Minho, we hope to

have contributed to an understanding of a few of the great problems which face the Portuguese in planning the further development of their country.

| *House-hold* | *Total number resident in house-hold* | *Working away from home* | | | | | | | | *Total working away from home* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *In Portugal* | | | *Europe* | | | *Overseas* | | |
| | | *Local area* | *Lisbon* | *Vila real* | *Spain* | *France* | *Brazil* | *Uru-guay* | *Angola and Mozam-bique* | |
| 1 | 1 | | | | | | 1 | | | 1 |
| 2 | 10 | | | | | | | | | — |
| 3 | 5 | | | | | | | | | — |
| 4 | 6 | | | | | | | | | — |
| 5 | 3 | | 1 | | | | | | | 1 |
| 6 | 5 | | 1 | | | | | | | 1 |
| 7 | 7 | | | | | | | | | — |
| 8 | 1 | | | | | | | | | — |
| 9 | 2 | | | | | | 1 | | | 1 |
| 10 | 1 | | 1 | | | | | | | 1 |
| 11 | 6 | | 1 | | | | | | | 1 |
| 12 | 2 | | | | | | | | | — |
| 13 | 9 | | | | | | | | | — |
| 14 | 5 | | | | | | | | | — |
| 15 | 8 | | | | | | | | | — |
| 16 | 3 | | | | | | | | | — |
| 17 | 2 | | | | | | | | 1 | 1 |
| 18 | 4 | | 2 | | | | | | | 2 |
| 19 | 9 | | | | | | 3 | | | 3 |
| 20 | 4 | | | | | 1 | | | | 1 |
| 21 | 6 | | 1 | | | | | | | 1 |
| 22 | 1 | | | | | | | | | — |
| 23 | 9 | | 1 | | | | | | | 1 |
| 24 | 4 | 2 | | | | | | | | 2 |
| 25 | 2 | | 1 | | 1 | | | 1 | | 3 |
| 26 | 4 | | | | | | | | | — |
| 27 | 6 | | | | | | | | | — |
| 27 | 6 | | | | | | | | | — |
| 28 | 7 | | 2 | | 1 | | 7 | | | 10 |
| 29 | 8 | 1 | | | | | 1 | | | 2 |
| 30 | 10 | | | 1 | | | | | | 1 |
| 31 | 4 | | | | | | | | | — |
| 32 | 7 | | 1 | | | | 1 | | | 2 |
| Total | 161 | 3 | 12 | 1 | 2 | 1 | 14 | 1 | 1 | 35 |

MIGRATION FROM ORBACEM 6 Sept. 1954

Detailed breakdown of general picture given in Figure 2

## DISCUSSION

*Afternoon Meeting, 4 April 1955*

Before the paper the CHAIRMAN (Dr. E. W. H. BRIAULT) said: The purpose of the paper this afternoon by Mr. Hayes is to give an account of some work last year in Portugal. In 1953 three men, then in their first year at Cambridge, did some field work in northern Portugal. It was decided that they should return with a larger party in 1954 to undertake an expedition officially recognized by the Royal Geographical Society, Cambridge University and the Anglo-Portuguese Society.

*Mr. Hayes then read his paper*

THE CHAIRMAN: You will agree that we have listened to a most stimulating paper. I call on Dr. Houston to open the discussion.

Dr. J. M. HOUSTON: I should like to congratulate Mr. Hayes on his excellent paper, and in particular on his maps. I should like to raise a few points: though Mr. Hayes has covered a great deal of the territory and the subject matter, it is a pity that not

more was said about the geology of the country. I believe the contrast between the granite and the schists is fundamental to the geology of north Portugal, and I should like to ask whether the geological formation across the valley of the Rio Âncora is not in fact schist, which makes a contrast between the soils of this and the surrounding country.

With regard to the crops in this "climax" region, it would seem that any modern changes introduced would upset the equilibrium which has been so painfully evolved over the centuries. But there are revolutionary possibilities in the introduction, for example, of hybrid maize. And what are the limits of olive and vine culture in the valley? And what the trends in yields of rye and potatoes? Another question—what are the likely developments in hydro-electric power? Finally, as to land tenure, is not fragmentation in this region one of the fundamental problems, and what legal provisions are there for the unification of the holdings?

Mr. B. H. FARMER: I too should like to congratulate Mr. Hayes and his colleagues on the results of their labours, and on the energy and skill with which they marshalled their resources to get to Portugal and undertake this work. I have a little pamphlet on 'Financial aid for geographical research,' compiled for the Society by Professor Balchin, but even the author of that compilation might have something to learn from the expedition.

I welcome this work as a contribution to the human and economic geography of peasant societies in which quite different factors affect patterns of economic activity from those which prevail in commercialized societies. Has Mr. Hayes any figures for the amount of crops sold in relation to total production?

Is emigration causing family decay? And what is the effectiveness of legislation governing the use of water? Is there any kind of conflict between legislation imposed by the central government, and local custom? Experience in South-east Asia suggests that such conflict often arises.

Mr. P. HAGGETT: While in Portugal we were strongly impressed by both the scope for field work within the country, and for the facilities available for such research. We were privileged to work for short periods at the Statistical Library of the Instituto Nacional de Estatistica at Lisbon, and found there an immense fund of material on the economic development of Portugal. It was interesting to find a wealth of detail on inter-regional freight movements in the early railway statistics—detail which is, by and large, denied to economic geographers working in other lands. To these opportunities are added the friendliest cooperation and assistance from government and university sectors—cooperation which added greatly to both the pleasures and the profit of our work.

Mr. R. D. HAYES: In consequence of geological work which has been done by others, the question of the granite/schist boundary—which Dr. Houston has raised—is being investigated. Anything said at the present must be tentative as our soil samples have not yet been analysed. Our preliminary conclusion is that the difference of structure does not markedly affect the soils which owe most of their character to the working, cropping and fertilization they have received. The greater significance of the different geological structure lies in the topography, for it is the cause of the contrast between the upper and lower valley.

Turning to the problem of maintenance of equilibrium in the face of modern changes it is important to bear in mind its dual aspect. It cannot be too firmly emphasized that in our opinion the equilibrium is beginning to break down in face of such factors as rising population, changing standards of living in the rest of Portugal and Europe and the steady development of education. To do nothing will contribute as greatly to disequilibrium as will taking positive steps.

The question of yields is one to which we cannot give a wholly satisfactory answer. So far as detailed information by questioning in the field was concerned answers were unreliable. The difficulty lay primarily in the lack of any accepted standard of measure among the peasants, and for this reason we have not attempted any local

generalizations. The smallest unit for which statistics are available is the Administrative District; we have taken manuscript copies of these records but their investigation has not yet been undertaken. Regarding the olive, I can only say that this was grown everywhere that cultivation of other crops was possible—about 1000 feet would be the highest local level. However, it should be borne in mind that yields from tree crops in the district are generally poor and it is certainly not self-sufficient in olive oil.

Rural electrification has scarcely reached Âncora. There are, it is true, telephones there, and two electric mills, but the peasants continue to use the ordinary water mills in preference. Electrification is likely to have an increasing significance, although development must be slow, as power is very precious in Portugal and her industry and transport are bound to have priority. The proposal to press ahead with a national grid will probably slow rural electrification in the north as the greater returns from the national point of view would accrue from using the power in the more southerly towns.

Fragmentation, I agree, is one of the fundamental problems of the area and from the point of view of economic production some unification of holdings would be an advantage. It seems likely, however, that at the present time there is concealed underemployment as a result of this inefficiency. Any rationalization must presuppose plans to absorb the released population; this is a serious point when it is remembered that over-population is already a major problem.

Turning to the questions of Mr. Farmer, the legislation on the water question is only indirect, for it provides for the licensing of water pumps, the grant or refusal of a licence being decided at local level. There is no sign as yet that Government legislation conflicts with the traditional methods of settling these problems. The peasants are in fact generally ignorant of all but the simplest legislation.

The question of the proportion of produce sold was one which concerned us a good deal and again we were in difficulty in linking local data with official statistics. I can only say that the information gained from our questionnaire suggests wide variation in the importance of cash sales from peasant to peasant. Further, since it is a question of haphazard sale of surpluses rather than a planned cash economy wide variations will occur from year to year. Wine and timber seem to be the most regular items for sale.

# THE GEOGRAPHICAL DISTRIBUTION OF THE WELSH LANGUAGE

J. GARETH THOMAS

THE 1951 CENSUS 'Report on Welsh Speaking Population' [1] is a report on a language which is statistically in an undeniable state of decline, and it has been recognized as such by statisticians concerned with Welsh affairs.[2] This situation, so clearly reflected in the tabulated statistics of the 'Report,' is the result of a number of factors appertaining to geography, history and sociology, and this paper is devoted to a tentative appraisal of some of these influences upon the present-day distribution pattern. It will be concerned primarily with an overall pattern and will not therefore seek to demarcate or compare linguistic divides, for this, as D. T. Williams's work for 1931 has shown,[3] must await more detailed field work in order to elaborate the published figures. There are three aspects which invite consideration. The first concerns the total numbers of people who are able to speak Welsh, whether they be bilingual or monoglot, and this may be termed the "quantity factor" of the language. The second deals with the pattern of distribution which is presented by this Welsh-speaking element in relation to the total population in the various regions of the Principality. This is the "intensity factor," and its statistical basis in this case is that of the Civil Parish (see map on p. 72). The third is more specialized, and is concerned with the monoglot Welsh element in the overall population.

Before dealing with these three aspects there are, however, a number of weaknesses in the source material which should be mentioned. One of these is the fact that only in Wales [4] did the Census forms contain a question on the language spoken. Welsh speakers outside the Principality were unable to record themselves as such, so that all figures relating to the language apply to Wales alone. In the light of the inter-war migration out of Wales it would have been of great interest to have been able to trace the incidence of Welsh in various parts of England's "axial belt," but it proved impossible to include provision for this information on a national scale. A second weakness in the statistics concerns the registration of those people who, in the terms of the Census question were "able to speak Welsh only." The Report itself admits to the "possibility of confusion between ability (to speak) and habitual use" of Welsh,[5] and the final figures seem to indicate that some confusion did indeed arise. Thus the two most anglicized counties, Radnor and Monmouth, show increases of monoglot Welsh speakers between 1931 and 1951 of 7 and 37 respectively. In one Radnorshire parish one monoglot Welshman is recorded, and only *one* man who can speak both English and Welsh, so that if these figures are true, the monoglot Welshman must be severely restricted in conversation. Even anglicized Cardiff is reputed to have 136 monoglot Welsh people, nearly three-quarters of them between the ages of 10 and 65. There has obviously been some confusion here, not merely between "ability" and "habitual use" but also possibly in the interpretation of the term "ability to speak," for though many people, especially in the upper age groups, have an ability to speak English, they are not "at home" in it and may therefore have been registered as monoglot Welsh. Finally, one must not ignore the possibility that for political reasons some people might prefer to register themselves as monoglot Welsh.

[1] H.M.S.O., July 1955.

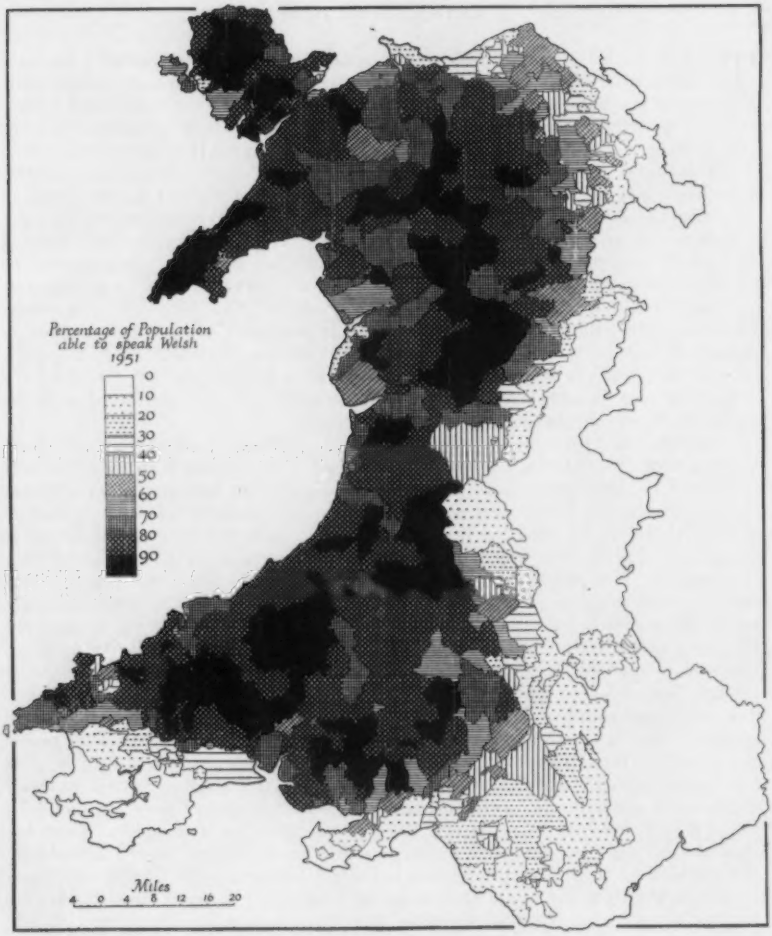
[2] See *inter alia* the *Western Mail* for 6 July 1955.

[3] Williams, D. T., in Archaeologia Cambrensis, Vol. xc, Pt. 2, 239–66; Vol. xci, Pt. 2, 194–209.

[4] Throughout this paper the terms "Wales" and "Principality" should be taken to include Monmouthshire.

[5] Report, p. vi.

The last weakness of the statistics is undoubtedly the greatest, for although the Census recorded the "ability" to speak Welsh, it naturally could not give any indication as to whether that language were used in everyday life, either socially or from a business or professional standpoint. Thus though in Radnorshire there are 957 people who are able to speak Welsh, and 827 in Monmouthshire Rural Districts, the




total populations for those two units are 19,133 and 42,322 respectively, so that some of the people with a knowledge of Welsh must only be able to use it on rare occasions. Only by field work can the statistical information be supplemented. Within these general limitations, however, the Census Report does give a comprehensive picture of the state of the language.

The total number of persons speaking Welsh [1] in Wales in 1951 was 714,686 or

[1] This term includes monoglot and bilingual Welsh people.

28·9 per cent. of the total population of just under two and a half million. This figure represents a decrease of 194,575 or 21·4 per cent. from 1931, when 36·8 per cent. of the population was able to speak the language.[1] During this twenty-year period, moreover, the total population remained fairly static, though in comparison with the remainder of Britain, this figure represents a relative decrease. Table B of the Report reveals that in 1901 49·9 per cent. of the population was Welsh-speaking, and that in every succeeding Census there has been a decline of varying sharpness. Thus by 1911 the percentage had dropped to 43·5 and by 1921 to 37·1, while from 1921 to 1931 there was only a slight drop to 36·8 per cent., the periods of sharpest decrease being those from 1901 to 1921 and from 1931 to 1951. There is here an interesting correlation with the overall population trends for these periods, though this correlation is less direct than would at first sight appear. Thus the first period of sharp decline, from 1901 to 1921, which accounts for nearly two-thirds of the reduction in Welsh speakers during the present century,[2] was a period of industrial expansion when, in the South Wales coalfield at least, there was some immigration from outside Wales, particularly from the Bristol and Forest of Dean regions. This immigration undoubtedly contributed to the decline, which though general throughout Wales, was particularly marked in the counties of Monmouth and Glamorgan.

The period 1921 to 1931 was in Wales as elsewhere one of economic depression, and the demographic picture was one of migration, both from the land and from the older industrial areas. Though there was now a considerable drop in the total population, there was hardly any fall in the proportion speaking Welsh (37·1 per cent. to 36·8 per cent.). If the county figures are compared, it becomes apparent that while there was a decline in the industrial counties of Glamorgan, Monmouth and Flint, together with the rural shires of Montgomery and Radnor, elsewhere the proportion was either static as in Brecknock, Carmarthen, Denbigh and Pembroke, or increased, as in all the remaining counties. Underlying these figures, however, is the fact that if the proportion of monoglot Welsh people is considered separately, then the decline for the whole country was from 6·3 per cent. to 4 per cent., a decline in which every county had a share.[3] What increases there were in the people speaking Welsh, were at the expense of the numbers speaking Welsh *only*, and represent an increase in bilingualism drawn from the Welsh and not the English monoglot source. The fact remains that a period which was demographically disastrous for Wales appears to have been much less so for its language, which was holding its position.

The improvement in economic conditions during the inter-censal period 1931 to 1951, especially marked during the war and post-war periods, is paralleled by a serious deterioration in the state of the language both in the monoglot and bilingual element. All counties show a decline in the proportions of both groups, and since the overall population figure was virtually static, the numerical decline is also considerable. A decrease in the numbers of monoglot Welsh speakers is partly to be expected as universal education allows everyone to acquire English as a second language. This need not be disastrous provided that the already bilingual element in the population retains its bilingual characteristics and provided that there is a reciprocal stream of English monoglots who acquire Welsh as a second language. This is not happening in Wales at the present time; it is quite obvious that the monoglot Welsh element is tending to become bilingual, that the bilingual element is becoming monoglot English, and that the originally monoglot English element is making no change. Bilingualism in Wales is usually a unilateral affair; only one side of the population acquires it and more often than not, tends to lose it in two or three generations.

What would appear therefore from this overall "quantity" and "intensity" decline for Wales is that the Welsh language is unable to maintain itself against its more powerful neighbour, and that bilingualism is only a stage between monoglot Welsh and

[1] Report, Tables A and B, pp. vi and vii.
[2] Report, p. viii.
[3] Report, Table 3.

monoglot English. There are many reasons for this, some of them political in origin and now sociological in operation. Only recently has Welsh attained any official status as a language, for not until the 1944 Education Act were the two languages given equal footings in the educational system of the Principality. Likewise, only in the post-war period has any government made any real attempt to use the Welsh language for its official publications, returns, etc., and not until 1941 was Welsh admissible as a language in a Court of Law. By contrast, the authors of the 1870 Education Act really believed that the Welsh language was a hindrance to the people and therefore ought to be discouraged, and because of this traditional attitude, the Welshman was restricted in his activities unless he acquired English as a second language. In past generations also there was a certain snob value in being able to speak English and not Welsh—a snob value which, interestingly enough, is now tending to act in reverse. Above all is the fact that there is no economic motive (except in very few instances) for anyone to learn Welsh or even to keep up his knowledge of that language. Although many professional bodies in Wales now require a knowledge of Welsh from applicants for appointments, this effect is limited. There has, in addition, been within Wales itself considerable apathy concerning the fate of the language, and Welsh-speaking families frequently have not troubled to maintain the language in the home. These are some of the factors which hastened the death of the Welsh language in regions which became bilingual. There has of course been a strong post-war revival of Welsh national life, both political and cultural, and though both movements are vitally concerned with practical measures to save the language, their efficacy has yet to be proved.

Having thus briefly touched upon the overall picture of the Welsh language it now remains to consider the way in which the various influences have acted on a regional basis, and here more strictly geographical factors have played their part. The map on p. 72 shows the percentage of the total population able to speak Welsh (i.e. monoglot and bilingual) in 1951, calculated and plotted on a parish basis. It reveals that the Principality may be broadly divided into four "linguistic regions." The first is a region of almost complete anglicization and the second is one of admixture. The third forms "pockets" or "strips" of anglicization, isolated in the fourth region which is one where Welsh speakers predominate.

The first region, where the percentage of Welsh speakers does not exceed 10, consists of those areas adjacent to England, with broken extensions westwards into the Vale of Glamorgan, through the Gower peninsula to St. Bride's Bay. It includes much of Flintshire (all the detached portion of the county) and part of Denbighshire, thus forming a north-eastern sub-region. A central, or "Middle Borderland" sub-region is formed by Montgomeryshire south-east of the upper Severn, or Vale of Powys, and the whole of Radnorshire, while south-east Brecknockshire, south-east Glamorganshire and the whole of Monmouthshire may be regarded as a sub-region in the south-east corner of Wales. South Pembrokeshire forms an anomalous sub-region in the west, to which may be added a part of the Gower peninsula. It is not without significance to the geographer that the breaks between the north-east and central sub-region, and between this latter and the south-east are to be found in areas where uplands reach the English border, in this case the Berwyn foothills and the Black Mountains of Brecknockshire. It is even more significant that the county which presents the most imposing upland front to England is that of Radnor, a county which vies with Monmouth for the position of being the most heavily anglicized county in Wales, so that sweeping physical correlations are of little value. Yet some physical correlations appear to operate, for along the Vales of Llangollen, Powys, Wye and Usk there are embayments of anglicization, often unfortunately masked on the map by the fact that the whole of these areas falls into the 0–10 per cent. category.

There is of course nothing particularly new in this situation,[1] although between

[1] Williams, D. T., "A linguistic map of Wales according to the 1931 Census," *Geogr. J.* 89 (1937) 146–51.

1931 and 1951 the area with a Welsh-speaking proportion of under 10 per cent. has extended considerably to the west especially in Brecknockshire and south-east Montgomeryshire. When it is borne in mind that Welsh tends to lose ground in any area which becomes predominantly bilingual, then the picture can be explained by the operation of a set of historical, physical and economic factors. The primary factor from the standpoint of time was, of course, Anglo-Norman penetration into those regions which came to form part of the Marches of Wales. This penetration with its associated feudal and manorial organization, if it did not actually displace the native population, at least introduced into it a non-Welsh-speaking element which would inevitably go out of its way to maintain its identity. This penetration would naturally be greatest in regions contiguous with England, and within such regions would be most marked where physical conditions favoured a manorial organization with its associated farming system and settlement. Thus, penetration and consolidation were extensive in the eastward-looking valleys of the Welsh Borderland, not merely in the larger vales of the Dee, Severn, Wye and Usk, but also in the lowland embayments provided by the tributary systems, in particular those smaller rivers such as the Onny, Teme, Lugg and Arrow whose valleys open out towards Ludlow and Hereford. Similarly accessible, and equally attractive, were the fertile and comparatively low-lying regions of the Vales of Gwent and Glamorgan, Gower and South Pembrokeshire, this last having experienced in addition a deliberate plantation of Flemings, and, much later, a reflex movement of Anglo-Irish from disturbed Tudor Ireland. The initial anglicization in the Marches of Wales, therefore, is an example of an historical process operating in a favourable physical environment.

Second to this historical process in point of time, but superior to it in its numerical results, was the impact of the Industrial Revolution which led to enormous concentrations of population in the two coalfields, particularly in that of South Wales. In the North Wales field the overall population density is less, and immigration into the region appears to have been less marked, possibly because the coalfield occurs in a relatively low-lying area which would have been able to support an average density of pre-industrial population. The coalfield in the south, however, was developed in a dissected plateau region, which, particularly east of the Vale of Neath, could only have supported a sparse population when dependent solely upon agriculture. Thus the impact of industrial development upon the linguistic picture appears to have been most marked in the eastern half of the South Wales coalfield. In North Wales the map shows that linguistic admixture, rather than wellnigh complete anglicization, has been the result. In the new industrial settlements of south-east Wales, however, many immigrants came from outside as well as from within Wales, so that English became the language of business and of commerce. This new wave of anglicization was, moreover, attacking regions which by virtue of their physical background had been relatively untouched by the preceding Anglo-Norman influences. Thus it is that by today both upland and lowland Monmouthshire have been engulfed by the tide of anglicization, a tide which has also penetrated deep into the hill region of east Glamorgan.

Historical, physical and economic factors have thus operated to initiate the process of anglicization in these areas, a process which from its inception is self-propagating. More recently, and particularly in the rural areas, complex geographical factors have operated to assist this propagation. Those regions most suited to Anglo-Norman military penetration and agricultural settlement are those which are agriculturally most prosperous at the present time. They are the regions which have greatest ease of access to market towns whose anglicizing influence will be dealt with below, and they are the regions with the greatest commercial contacts across the English border, the regions, for example, where commercial dairy farming has experienced an enormous expansion in the last twenty years. Chester, Shrewsbury and Hereford are the regional capitals for many of these areas in Wales, and the larger market towns even within the Welsh border are almost completely anglicized—Welshpool for instance. Under

these conditions a knowledge of English is essential, and the older language becomes atrophied and dies. Anglicization is thus not merely confirmed, but with increasing agricultural prosperity is expanding westwards.

Within this eastern borderland there are one or two regions whose linguistic conditions are somewhat anomalous. The first is on the boundary of Shropshire and Denbighshire, where, judging from the map on p. 72, there is an overspill of Welsh speech into the English county west of Oswestry. The second is the county of Radnor, an upland county, though broken by many valleys which counteract this fact, and yet which is now completely anglicized. The position is somewhat clarified when one remembers that the counties in question date from the Acts of Union of 1536 and 1542 and that they were created purely as administrative units without any reference to the linguistic conditions then obtaining. Some Welsh-speaking areas were thus given to Shropshire, while Montgomeryshire and Radnorshire appear to have included some areas which were at that time already English in speech. It is worth noting that in the Denbighshire/Shropshire region quoted above, Offa's Dyke, which was probably far more valid in its day as a political frontier than were the shires of the Act of Union, runs inside the English county, while in south-east Montgomeryshire the reverse is true. Even so this does not fully explain conditions in Radnorshire, for as late as the eighteenth century the western portion of this county appears still to have been bilingual.[1] Various reasons have been quoted for the decline of Welsh in this area, ranging from the story that part of the Cromwellian army was disbanded here and settled on the land, to the assertion that the county's poverty has prevented its people from reacting to the stimulus of the nineteenth century reawakening of Welsh cultural life.[2] It must however be remembered that upland Radnorshire can easily be penetrated from the south-east by way of the river valleys mentioned on p. 75, and indeed from prehistoric times onwards they have formed major routeways into Wales,[3] while from the north-east there is another route of access via the Vale of Powys. The bilingual part of the county would therefore be open to anglicizing influences on three flanks, its market towns were in the already anglicized lowlands, and the sparse population of the upland core had no contact with Welsh life or with Welsh-speaking regions. Thus the language was lost, though the vocabulary and idiom of Radnorshire English still retain some traces of Welsh.

The first of our "linguistic regions" therefore, that of almost complete anglicization, appears as the result of the interplay of diverse factors, not the least of which is the sociological fact that in any bilingual area, Welsh always tends to lose ground. It is only natural that the second region should be one of linguistic admixture, and equally natural on geographical grounds that this region should appear on the map as a continuous fringe "inside" the zone of complete anglicization. This fringe is narrower, however, and the transition smoother, in the rural areas than it is in the two industrial regions, for in this latter case migration of population has resulted in a much less regular pattern. It is also of significance that while this transition zone extends west of the North Wales coalfield, it does not include the whole of the South Wales industrial region but tends to stop along the approximate line of the Vale of Neath. The anthracite region to the west of this vale has never been so completely divorced as has its eastern neighbour from its agricultural background, which was in any case more prosperous in the west. The association of smallholder and anthracite miner is certainly less common today than it was, but it seems to have slowed down the process of anglicization, while there is also the simple locational fact that this region would draw more of its immigrants from predominantly Welsh areas to the west.

This transition region is an interesting and gloomy pointer to what would appear to be the ultimate fate of the Welsh language; for if the 1951 figures for its administrative

[1] Darlington, T., 'Radnorshire and the Welsh Language.' Wales, Vol. 2 (1895) 31–2.

[2] Quoted by Williams, D. T., in *Arch. Camb.*, 90, Pt. 2, p. 245.

[3] Cf. Chitty, L. F., "How did the Iron Age fort builders reach the Breidden?" *Arch. Camb.* 92 (1937) 129–50.

units be compared with those for 1931, they will reveal an all round decline. This is the region where the language, though still in use, is waning; it is fast becoming confined to the older generations, and it is here that is to be found the "linguistic divide" plotted by D. T. Williams for 1931.[1]

The third linguistic region is made up of pockets of anglicization, in some cases isolated from the eastern and southern areas which have already been discussed. Two such pockets, in this case elongated, occur along some of the coasts of Wales. The first is a continuous strip extending along the north coast westwards from Flintshire to the Great Orme peninsula, while the second is a more discontinuous zone along the "Cambrian Coast" between Aberystwyth and Criccieth, with isolated pockets along the southern coast of Lleyn. Linguistic conditions in these regions are linked with their popularity as tourist centres, the north coast in particular drawing on Lancashire and Cheshire, and the west on the Midlands. Not only does English become the essential commercial language for Welsh people living in these regions, but their population also contains a considerable English immigrant element, not merely connected with the tourist industry, but also as a purely residential class of retired people who at their time of life are not likely to learn a second language. On the west coast also the anglicization is intensified by military establishments, as at Trawsfynydd and Tonfanau in Merionethshire, and further south, at Aberporth in Cardiganshire. Here more detailed field work is needed, for some of the coastal parishes, e.g. that of Towyn, extend inland, so that if the coastal townships were to be isolated, the contrast on the west coast between the narrow coast fringe and the uplands to the east would be much more intense than in the north. The effect of the tourist industry on an inland area is also illustrated in rather a startling fashion on the map, p. 72, by the figure for the Bettws-y-Coed/Capel Curig region, though here it must be remembered that the enumeration took place in April which is a popular period for climbers in Snowdonia and the picture may have been a little distorted.

A second element in this region of "pockets" is provided by some of the rural market towns of Wales, towns which have, in general, been unaffected by any large scale industrialization. For example Carmarthen and Llandilo, Brecon and Llanidloes, Llanwrst and Beaumaris stand out as towns wherein anglicization is greater than it is in the surrounding hinterland. Many of these towns were of course deliberate Anglo-Norman foundations, and a non-Welsh-speaking element would be introduced into them in the same way as it was into the Welsh Marches. Such towns have therefore developed a core of English monoglots and this has resulted in English becoming predominant in business and commerce; public cattle sales and auctions, for example, being invariably conducted in it. By analogy with Radnorshire (*v.s.* p. 76), this situation is likely to have a slow but sure effect upon the Welsh-speaking hinterlands, particularly at the present time, since, as has been pointed out elsewhere by the writer,[2] urbanization seems to be increasing within the Principality. Towns which also fall within this linguistic group, though for a different reason, are centres of communications, especially when, as in Wales, they are concerned with transit traffic and not with internal movement. Thus Fishguard and Holyhead, particularly the former, have proportions of Welsh speakers much lower than those of the surrounding regions.

The remaining linguistic region is that of the essentially Welsh-speaking core, a region wherein geographical factors of inaccessibility and comparative lack of economic development have operated to preserve the native language. It may be regarded as consisting of those areas where over 70 per cent. of the population is able to speak Welsh, and it includes the mountain and upland core, together with Anglesey, Lleyn and the coastal plateau of south Cardiganshire. Though this region is shown on the map as one which is predominantly Welsh in speech, yet the linguistic picture is less healthy than would at first sight appear. In the first place, though the "intensity

[1] Williams, D. T., *op. cit. Arch. Camb.*

[2] See 'The Welsh Anvil,' Vol. IV, 1952, pp. 87–97: "Population Trends in Wales."

factor" of the Welsh language is high, the "quantity factor" is low in this region, for it is a region of generally sparse population, much of it being virtually uninhabited, e.g. the Snowdonia core, and the moorlands of the Berwyns, the Cader Idris and Arenig ranges, and Plynlymmon. Demographically therefore much of the region is negative, and even its inhabited regions are suffering from rural depopulation.[1] With the exception of Anglesey and parts of Lleyn, those areas which show a proportion of Welsh speakers of over 90 per cent. are of little significance in the overall numerical picture. If the language is to depend upon such regions for its survival, then its fate is already sealed. Secondly, if the 1951 map is compared with similar maps for the 1931 Census [2] it will be seen that even in this predominantly Welsh-speaking region there has been a decline in the intensity factor during the last twenty-year period, a decline which is very apparent if the figures of individual areas are compared. The areas where over 90 per cent. and over 80 per cent. of the population are able to speak Welsh have been considerably reduced, particularly in Anglesey, Lleyn, Merioneth and south Cardiganshire, all regions on the westwards side of Wales where historical and geographical factors would tend to operate against anglicization. While it is emphasized that these areas are still predominantly Welsh in speech, yet it is apparent that in the last twenty years the English monoglot element has increased, while it may be mentioned in passing that within the Welsh-speaking population the number of monoglots has declined sharply (e.g. from 23·9 per cent. to 9·6 per cent. in Anglesey). Obviously these regions are becoming bilingual in the same way, though not for the same reasons, as did the Welsh Marches in an earlier period.

It is not easy to find a definite reason for this new, though as yet not disastrous, decay of the language in these traditionally Welsh regions. They are areas of rural depopulation and it may well be that the attempt to prevent this trend, e.g. the development of services, and of activities such as those of the Forestry Commission, has introduced a limited but significant English monoglot element into the population. Above all, of course, is the decline in Welsh monoglots, and the fact that for every Welsh monoglot who acquires English as a second language there is no economic motive for a reciprocal trend. Thus even in the western and mountain redoubts, the ability to speak English is fast becoming universal and such regions are embarking on a linguistic voyage which for similar areas in the past has led to heavy anglicization.

This fact leads on to a consideration of a third general aspect, namely that of the overall decline in the numbers of Welsh monoglots. In 1901 approximately a half of the population of Gwynedd (Anglesey, Carnarvonshire and Merioneth) was monoglot Welsh, while in South Wales one-half of Cardiganshire's population and one-third of that of Carmarthenshire was in the same category. By today, however, in none of these counties is as much as one-tenth of the population enumerated as monoglot Welsh, Anglesey reaching the highest proportion with 9·6 per cent. This merely confirms what was said in the previous paragraph, but even more significant are the results, given in Table 4 of the Report, of splitting the monoglot Welsh element according to age groups, which shows that the highest proportion of Welsh monoglots occurs in the age groups 3 to 4, 5 to 9, and over 65. The percentage in the last age group (2·8) is of course residual, and belongs to a generation whose speech characteristics reflect a period when Welsh was much more widely spoken, while the younger age groups represent generations who have not yet acquired a second language. The fact that they normally do so acquire a knowledge of English is shown by the low proportion (under 1 per cent.) of Welsh monoglots in the age group 15–44. The overall figures show that for every six children who were monoglot Welsh at the age of 5 or 4, five acquire English before they reach their twenty-fifth birthday.[3] There is

[1] See 'The Welsh Anvil,' *op. cit.*

[2] Williams, D. T., *op. cit.*, especially *Arch. Camb.* where the same grading is used as on Figure 1.

[3] Report, p. ix.

everything to be said for the acquisition of a second language, but when the process is unilateral, and when in two or three generations it ceases to be maintained, then the future of the Welsh language is very black indeed.

A final word may now be said concerning the links which exist between the linguistic picture as shown on the map, and the contemporary demographic trends within the Principality. It is apparent that depopulation is affecting those very regions where Welsh is most strongly entrenched. The modern "valleyward movement of rural population" that is today going on in Wales as a result of agricultural prosperity in the lowlands is a movement from the Welsh to the anglicized regions. Not only is the source of this movement running dry, but its younger generations are themselves becoming less exclusively Welsh in speech. The language therefore would appear to be losing ground not only in the peripheries but also in the core of the Principality, and at the time of writing one can only wonder whether the post-war revival of interest in it and in the cultural life of the nation in general will be able to check the hitherto inexorable process of decay.

# SLOPE DEVELOPMENT IN BUGANDA

J. W. PALLISTER

THE VISITOR to Uganda Protectorate, arriving either by rail or by air, is immediately impressed by the characteristic scenery of flat-topped or, less commonly, rounded hills rising very nearly to the same height and separated by gentle slopes with valleys containing broad papyrus swamps. This scenery is typical of much of Buganda and particularly of the lacustrine belt around the north-west shores of Lake Victoria. Roccati[1] early commented on these features and wrote: "the scenery of the limonite (*sic*) region is typical in the form of its rising grounds. These do not present rounded contours . . . but constitute elongated hills with bevelled summits . . . representing the remains of what at other times must have been the unbroken surface of the ground." The flat-topped hills of Buganda were mentioned in the first of Wayland's Annual Reports [2] in which he expressed the opinion that they represented remnants of a former tableland whose origin was denudational. Subsequently he referred to the "Buganda peneplain" [3] and later, in 1934,[4] summarized what was known of peneplanation in Uganda when three erosional surfaces had been recognized; of these the "Buganda peneplain" is called Peneplain II. A number of workers, notably Bailey Willis, Dixey, King, Veatch, Cahen and Lepersonne have contributed to the considerable literature on east and central African erosion surfaces, and the "Buganda peneplain" has been correlated with the mid-Tertiary or sub-Miocene peneplain (Dixey) and with the Gondwana Surface (King). A brief account of this erosion surface has recently been written.[5] This paper is not, however, primarily concerned with this erosion surface, but with the intervening slopes separating it from the extension of the lower surface (Peneplain III, end-Tertiary, Africa Surface) of which the valleys of lacustrine Buganda are the imperfect representatives. In particular, it is of interest to observe the character of the slopes and draw what deductions are possible with respect to the climatic and other factors during the formation of the later erosion cycle, which has in turn had imposed upon it the effects of Pleistocene events.

## METHODS

The following account of some aspects of the geomorphology of the region is necessarily provisional, as topographical data are relatively scanty and have been mostly collected during a survey which was essentially geological. During field work based on the Uganda Protectorate Land Office Sheets (scale 1/50,000), form lines were added to an enlarged copy of the War Office Sheet North A.36, No. 1764 (1911) by means of frequent aneroid heights with an accuracy of $\pm 10$ feet. As a reconnaissance method 200 profiles of slopes were measured by a clinometer, and although inaccuracies arise from the irregularity of profiles due to forest and other vegetation, the consistency of the results gave some confidence in the method. None the less, many more observations need to be carried out in order to establish confidently mean slopes and variations about the mean. The accompanying map (Figure 1) is based on this reconnaissance work and shows features quite typical of the much more extensive lacustrine region of southern Buganda.

[1] In 'Ruwenzori,' by F. de Filippi, Appendix C. London, 1908.
[2] *Ann. Rept. Geol. Surv. Uganda* for 1920, para. 49.
[3] *Ann. Rept. Geol. Surv. Uganda* for 1925, para. 43.
[4] *Ann. Rept. Geol. Surv. Uganda* for 1933, paras. 366 *et seq.*
[5] J. W. Pallister, *Comptes Rendus, 19th Int. Geol. Congress*, Algiers, 1952.

GEOLOGY

Much of Buganda is formed of granitic gneisses and migmatites with thin bands of amphibolite, overlain by a series of phyllitic and sericite-schists. In the schist series are thin, though persistent, quartzite bands. All these rocks are considered to be Pre-Cambrian in age. A small outlier of Karroo (Permo-Carboniferous) shales on Entebbe peninsula is of too small extent to form any characteristic topography. Indeed, the present topography is little influenced by differences in bed-rock, with the exception of local ridges formed of quartzite. The dominant geological influences in the topography are, firstly, the presence of a lateritic "duricrust," and secondly, the deeply weathered character of the granitic and schistose rocks.

SLOPE ELEMENTS

Three remarkably constant slope elements can be identified: (a) the flat or slightly convex *hill-top*; (b) a steep *hill-slope*; (c) a *pediment*. While some of the larger hills, notably, Namasera, Mpumude, Kizi and Katumba, exhibit all those elements well developed, it is common to find the flat-top much reduced or absent, but the pediment, and to some extent the hill-slope, are identifiable by their regularity of inclination on nearly all hills whatever their size. The edge of the laterite "duricrust" is an important but not always prominent fourth element of the hillslopes.

(a) *Hill-top* (Photo 1 and 3).—Any hill attaining a height of 4250 feet and over is characterized by a typically laterite-covered near flat summit; while, on the peninsulas on the shores of Lake Victoria, Ziba, Tonda and Nsamuzi Hills have the same characteristics but are of less altitude on account of Pleistocene downwarp. In detail the "flat-top" is slightly dome-shaped, generally exhibiting a slight inclination of the surface down to its edges. This may amount to a fall of as much as 100 feet in the larger summits of the order of 2500 feet across, or a slope of about 5°. This, however, is somewhat exceptional. Although such slopes may partly represent the original undulation of the old mid-Tertiary erosion surface they are believed to be a more recent erosional feature indicated by the paucity or absence of soil near the outer margin as compared with a variable thickness of soil near the centre: a soil which by its position overlying thick laterite may date back to mid-Tertiary times.

Sub-surface leaching beneath the laterite "duricrust" is also a cause of marginal sagging, since shallow depressions or "sink-holes" on these hill-summits are common and small steps in the bare laterite surface near the margins are best explained by peripheral collapse. This surface corresponds to that of the "convex" or "waxing" slope described by Wood in his analysis of hillside slopes.[1] Surface denudation, especially near the edge is negligible; the laterite is very nearly in chemical equilibrium with the atmosphere and its erosion therefore is brought about by the physical agencies of leaching and under-cutting at its edge.

On those hills whose summits fall just short of 4250 feet the "flat-top" is replaced by a convex surface small in area and covered by lateritic rubble bearing witness to the recent final fragmentation of the "duricrust" (Photo 2).

(b) *Hill-slope* (*sensu stricto*).—The edge of the hill-top may be marked by a low cliff or sharp declivity 10 to 20 feet high formed by the edge of the "duricrust," and immediately below occurs a scree slope of about 100 feet altitude with a gradient varying between 20°–28°. The relative shortness of this slope makes an estimate by clinometer somewhat inaccurate. However, in the immediate neighbourhood of Mpigi, out of 35 slopes measured, 10 showed inclinations of 23° and another 6 of 24°. This angle is largely independent of the size of the flat summit. It is composed of rolled fragments of laterite about 6 to 12 inches diameter set in a clayey matrix, and supports a tussocky grass (*Hyparrhenia sp.* and *Cymbopogan afronardus*). On some hills a fringe of trees is found near the upper edge of the slope where active seepage from under the "duricrust" takes place. The slope in spite of its steepness is only

[1] *Proc. Geol. Ass., Lond.*, **53** (1942) 128–38.

rarely gullied, and that where a path or other artificial means has caused initial erosion. This slope is typically the debris or "constant slope" of Wood.

(c) *Pediment*[1] (Photos 1, 3).—The hill-slope descends with a regular but rapid change of gradient on to a pediment which has a remarkable constancy of slope. Of 100 clinometer measurements, 73 recorded angles between 5° and 8° with the majority measuring 7°. Moreover, there is usually only a slight decrease in the angle of slope from the top to near its lowest point. Occasionally there may be a distinct intermediate slope or upper pediment with an inclination of 13° to 15°, but almost invariably the change of gradient between hill-slope (*s.s.*) and pediment is rapid. It is especially remarkable that even on low hills without the flat summit or "constant slope," angles of inclination are 5°–7° and may therefore be considered as pediments. It is on these pediments that cultivation is well developed on a soil of considerable depth. The radial pattern of gardens on the pediments of hills which are circular or elliptical in plan is a striking feature which is well seen on air photographs of the district.

When fully developed this pediment decreases slightly in angle of slope near its base and develops a sheet of solid laterite or exhibits an abundance of lateritic pebbles (*murram*) which are found at higher levels, should the angle of slope flatten due to some underlying geological control. Rarely however is the base level of the pediment displayed, owing to a rejuvenation of the drainage.[2] The projection of the pediments on opposite sides of most of the valleys passes some 40 feet above the present papyrus-filled swamps, giving a measure of the degree of incision with due regard to the amount of aggradation which has also taken place. A minor convex slope between the pediment and the swamp is therefore developed. This again, as in the case of the upper part of the debris slope, usually supports a fringe of forest. (See Photo 3.)

Figure 2 shows profiles of typical hills in this part of Buganda. They form an evolutionary series in the erosion of the old mid-Tertiary surface (Photos 2 and 4). The stages in this local expression of the geographical cycle of W. M. Davis are described in another paper in course of preparation. It is shown that physiographic sub-division of the region can partly be based on the evolutionary stage generally characteristic of a local area.

There are a few exceptions to the type of hill slope and pediment first described. Steeply dipping quartzites have formed elongate ridges with slopes largely controlled by underlying structure. In one or two cases slopes are found with a very regular inclination of from 11° to 15° without an obvious control. Such slopes have a fairly continuous sheet of laterite at or near the surface. Examples are found at Mpigi and on the west side of Maziba Hill (Photo 1). It is thought that a local thickening of underlying amphibolite has given rise to an exceptional development of laterite which has interfered with normal slope development.

## SOIL AND VEGETATION ZONES

The validity of the slope elements is supported by the zoning established for soil and vegetation by Thomas[3] based on the "catena" concept of Milne.[4] Among a number of type localities, Thomas describes the hillside at Mpambire (Mbanga)

[1] "Piedmont slope" rather than "pediment" may be regarded as a more correct term for what is described in this paper. "Pediment" by general acceptance implies a rock-cut surface for which in this area there is little direct evidence, for depth of weathering is great. The soil veneer ("colluvium" of certain American authors) appears to be about 10 feet thick on the central part of the slope. The use of "pediment" is however preferred in this context in view of the essentially genetic relationship believed to exist between these slope elements and the more easily recognizable topographical features of arid climates.

[2] Some areas of ground with very low slopes of less than 5° and usually less than 2° at altitudes of around 3900 feet are thought to represent base level of the pediments in their neighbourhood, and therefore remnants of the end-Tertiary surface (see map).

[3] "The Vegetation of some Hillsides in Uganda," *J. Ecol.* **33** (1945) 10–43.

[4] *Soil Res. Brit. Emp.* **4** (1935) 183–95.

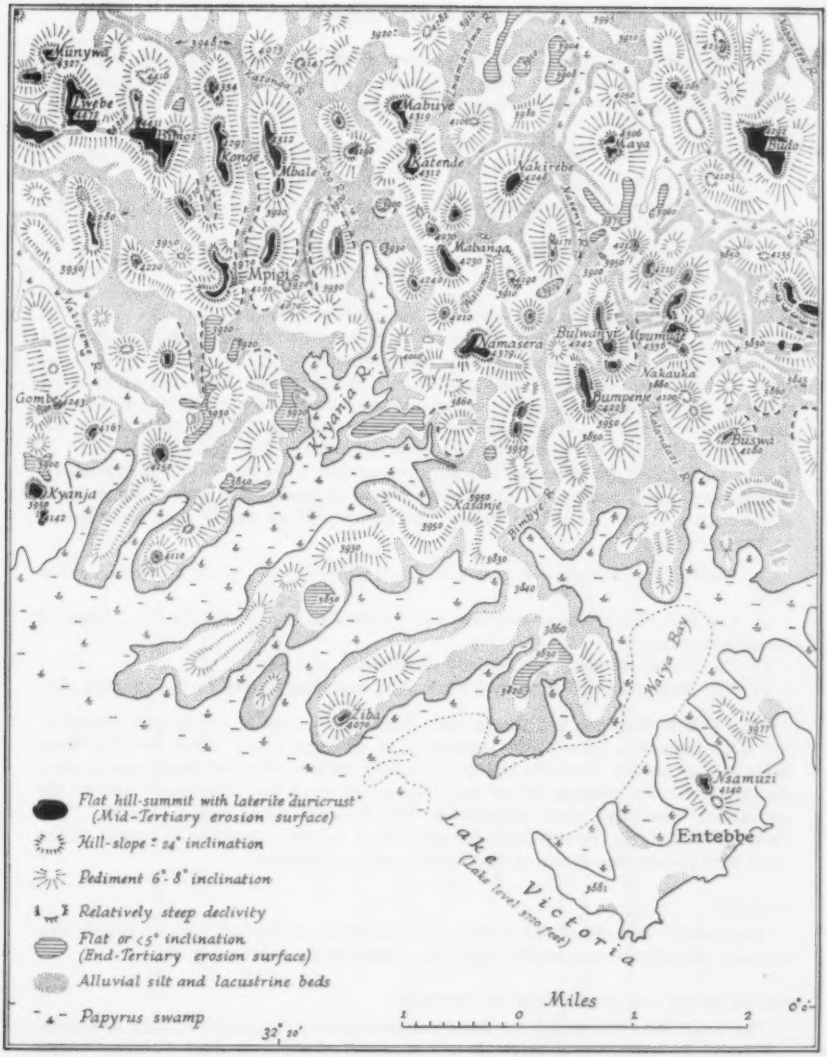



*Fig. 1. Geomorphological map of part of Busiro and Mawokota Counties, Buganda*

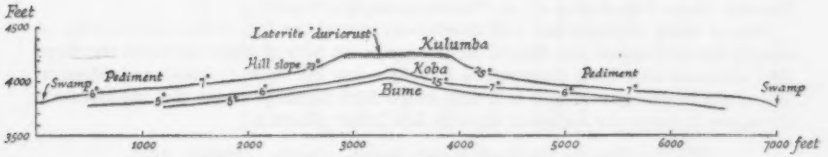



*Figure 2*

which lies about two miles west of the area of the accompanying map, Figure 1. Although part of the hill-slope is here interrupted by one of the rare outcrops of fresh gneiss in the region, the soil and vegetation catena corresponds to the slope elements.

| *Zone* | *Situation* | *Soil character* | *pH* |
|---|---|---|---|
| A | Hilltop Grassland | Brown loam | 5·5 |
| B | Elephant Grass and cultivation complex | Dark brown and red-brown loam | 5·0–5·5 |
| C | Evergreen Forest | Light brown, sandy loam | 5·0 |
| D | Papyrus Swamp | Dark brown, spongy clay | 5·0 |

Thomas describes Zone A as covering "the narrow flat top of the hill . . . and the first 100 m. of the upper slopes of the hill." *Hyparrhenia diplandra* is the dominant species of grass. The pediment forming Zone B supports in the natural state a dense mass of elephant-grass (*Pennisetum purpureum*), but is usually cultivated with annual crops of cotton, beans and maize or bananas and coffee shrubs. Although Thomas does not allude to the steeper slope in the Evergreen Forest Zone, he indicates the declivity on his sketch profile. Elsewhere at Nansagazi, some miles to the east of Kampala, Thomas describes the hill-top zone distinct from the slope which however is here structurally controlled, and though typical of this locality is not characteristic of the region as a whole. More recently the typical soil catena has been summarized by Sangster [1] as:

A. *The Hill-Brow Series*—A grey soil, black when wet . . . never more than 2 feet thick.

B. *The Red Earths*—Free-draining soils, with red-brown topsoils . . . often of considerable depth.

C. *The Swamp-Fringe Series*—Grey sandy soil.

D. *The Swamp Soils*—Intensely black soils overlying a grey or bluish-grey clay.

This typical Buganda soil catena may therefore be seen to be directly related to the slope elements, which have originated at different times. Thus the Hill-Brow Soils may be largely residuals of a mid-Tertiary surface, the Red Earths are derived directly from the breaking down and fragmentation of the "duricrust" and to the underlying weathered rock initiated in late Tertiary times and still active. The Swamp Fringe and Swamp Soils are alluvial or in part lacustrine in origin dating from later Pleistocene cycles of degradation and aggradation.

## CLIMATE

The present climate of the region may be classed as humid with an evenly distributed rainfall throughout the year, illustrated by the table on p. 85.

## DISCUSSION OF THE SLOPE-FORMING PROCESSES

The main facts which emerge from the preliminary investigation may be stated:

Firstly, the existence in Buganda is recognized of the four slope elements whose importance has been stressed by King [2]:

1. Waxing slope (margin of the hill-top). 2. Free Face ("duricrust" edge). 3. Detrital Slope (hill-slope *s.s.*). 4. Waning slope (pediment).

Not all these elements are well developed; indeed the free face is often partly or wholly buried beneath the detrital slope. Again, on hills of lower elevation the three first elements may have disappeared leaving a low hill with a coalescent pediment. But it can be recognized that it is only in the final decadent stages that the elements disappear to leave the pediment more or less intact (Photo 4).

[1] 'Working Plan for the South Mengo Forests, Uganda,' Entebbe, 1950.

[2] "Canons of Landscape Evolution," *Bul. geol. Soc. Amer.* 64 (1953) 721–52.

MEAN RAINFALL AT SELECTED STATIONS IN UGANDA (inches)

| *Station* | *Jan.* | *Feb.* | *Mar.* | *April* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Total in year* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Entebbe .. .. | 2·57 | 3·57 | 6·27 | 10·08 | 9·60 | 4·77 | 3·00 | 2·95 | 2·95 | 3·74 | 5·17 | 4·57 | 59·24 |
| Kampala .. .. .. | 1·82 | 2·40 | 5·07 | 6·91 | 5·77 | 2·89 | 1·76 | 3·42 | 3·62 | 3·82 | 4·80 | 3·90 | 46·18 |
| Jinja .. .. .. | 2·02 | 2·88 | 4·90 | 6·83 | 5·27 | 2·49 | 2·03 | 4·07 | 3·25 | 3·87 | 4·00 | 3·31 | 44·92 |
| Masaka .. .. .. | 2·20 | 2·54 | 4·59 | 7·17 | 6·82 | 1·87 | 1·41 | 2·07 | 3·42 | 3·87 | 3·85 | 3·32 | 43·13 |
| Mbarara .. .. .. | 1·55 | 2·61 | 3·68 | 4·59 | 2·89 | 0·91 | 0·88 | 2·49 | 3·92 | 4·01 | 4·51 | 2·92 | 34·96 |
| Tororo .. .. .. | 1·69 | 3·24 | 5·43 | 8·15 | 8·51 | 4·75 | 4·14 | 4·50 | 3·90 | 4·79 | 3·86 | 2·73 | 55·69 |

The above means have been calculated for the same twenty-year period ending in December 1947 with the exception of Kampala which is for seventeen years and Tororo for nineteen years each ending December 1947.§

§ "Some Aspects of Climate in Uganda, with special reference to Rainfall," J. P. Henderson, *Uganda J.* **13,** 1949, pp. 155–69.

Secondly, the slope elements retain their characteristic gradients on all hills on which they are present except in the final stages of degradation of the pediment. Parallel retreat of slopes is therefore characteristic.

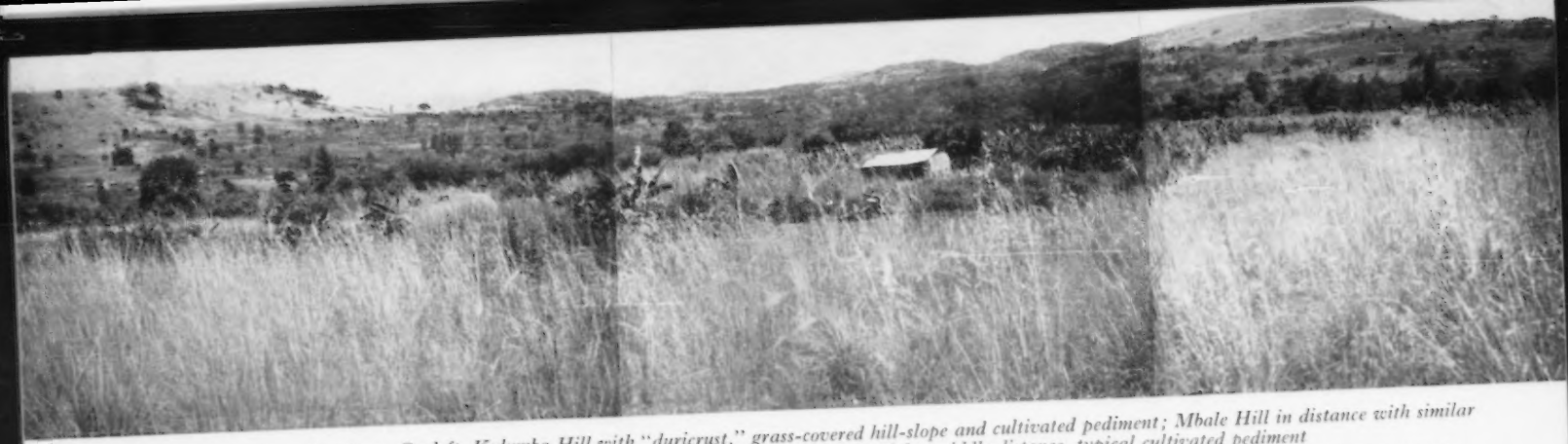
It is of interest to point out at this stage that these features of pedimentation were clearly recognized in Ankole by Stheeman in 1932.[1] He drew attention to the constant angle of slope of the hills and refers to the plains showing constant slopes of 4° to 6°; "plain and hill slope meet each other at a striking obtuse angle, without generally speaking, any intermediate angle of slope . . . obviously the climatic conditions favour two types of slope, namely a steep one of about 20° more or less abruptly changing into one about 5°. It is evident that the plain is formed by the recession of the steep slope . . . The scarps, therefore . . . have receded with a constant angle of slope." Different geological controls are present in Ankole as compared with Buganda, for the hills are largely composed of relatively fresh phyllite and a lateritic capping is less marked, but the importance of pedimentation is evident in both areas. Fair [2] has clearly demonstrated the combined influence of process and structure in parallel slope recession, where an important factor is the presence of hard horizontal bands of rock. He goes on to state that, "by contrast, the slopes of hills where composed wholly of shale and from which a hard cap has recently been removed, very quickly flatten to low mounds." This process of flattening, while not entirely characteristic of shale hills in parts of Uganda such as Bunyoro, is undoubtedly a typical process in Buganda once the laterite capping is broken up and removed and only deeply weathered granitic or schistose rocks remain. The erosional cycle in the part of Buganda described in this paper has not reached the late stage of flattened pediments and low convex interfluves but this type of topography is characteristically developed in north Buganda and in the extensive end-Tertiary Surface of the Northern Province of the Uganda Protectorate.

Thirdly, the initiation of a second cycle of erosion has only modified the lower part of the pediment by the formation of a narrow waxing slope. This limited influence however is mainly due to the relatively short periods of rejuvenation followed by aggradation, with the present very weak erosional activity of the main streams, save in certain very local areas, e.g. around Kiwala in Masaka District, where gullying is active.

One interesting feature needs further discussion. Very many pediments display a straight slope over most of their length with a concavity only in the upper part. Two reasons may be suggested for this characteristic. Firstly, the lower part of many pediments is slightly modified to form the incipient waxing slope of the next cycle; and secondly, the angle of any part of a slope is largely governed by the size of the particles contained in it. Now, the fragmentation of the "duricrust" is rapid until the particles are reduced to ironstone pellets about the size of a pea, at which stage they appear to resist further reduction. It therefore follows that the slope that is characteristic for particles of that size persists over a greater length than would occur where particles were being steadily reduced in size by the normal processes of attrition.

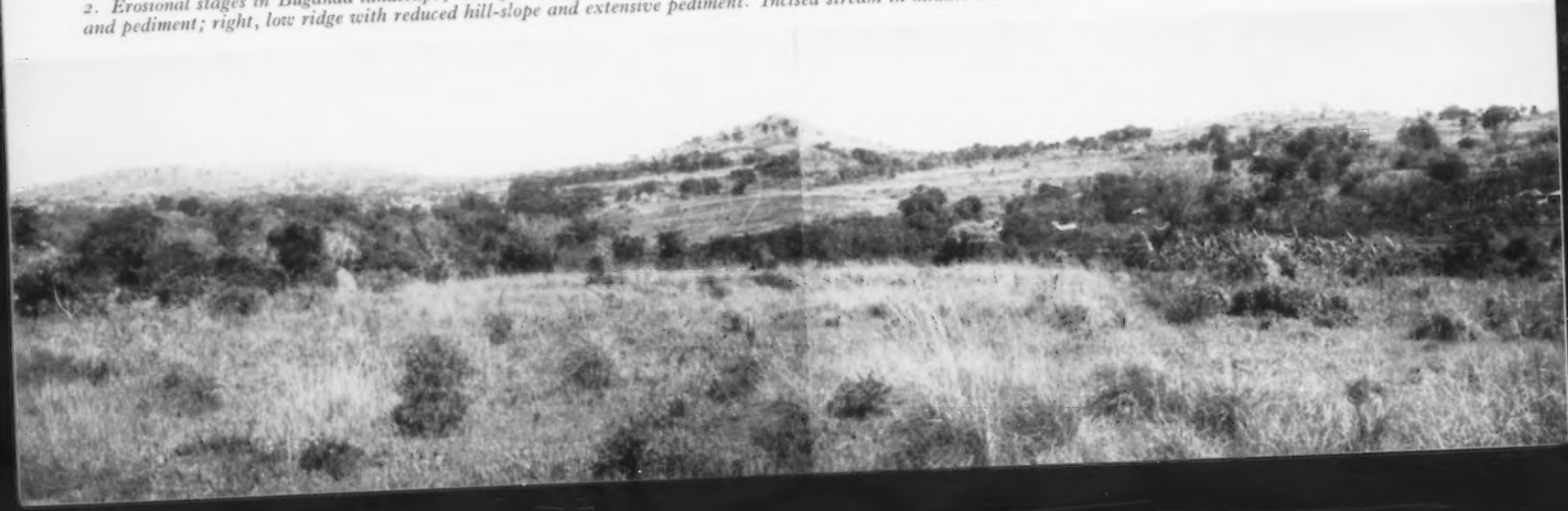
There has been little opportunity to study the agents of denudation most active in slope formation. The relative scarcity or absence of gullies on both pediment and hill-slopes eliminates the activity of streams. The general thick mantle of vegetation and moderately good soil structure combined with an evenly dispersed rainfall reduces the effect of sheet-flow. The most important factor appears to be that of gravity working by soil creep, assisted to a varying degree locally by sheet-wash and rill-wash. Frye and Leonard [3] describe the movements of the colluvial soil veneer down flanking pediments in the Great Plains Region of Kansas as one of "minor stream action, creep or lubricated creep and rill wash," where pediments are, to judge

[1] 'The Geology of South-western Uganda,' The Hague, 1932.
[2] *S. Afr. Geog. J.* **30** (1948) 71–9.
[3] "Pleistocene Geology of Kansas," Bul. 99, *Geological Survey of Kansas*, 1952.



*1. Typical Buganda valley form. On left, Kulumba Hill with "duricrust," grass-covered hill-slope and cultivated pediment; Mbale Hill in distance with similar elements developed; on right Maziba Hill, with straight hill-slope largely laterite-covered; right, middle distance, typical cultivated pediment*

*2. Erosional stages in Buganda landscape; on left Namasera Hill with extensive lateritic duricrust, hill-slopes and pediment; centre, Koba Hill with hill-slope and pediment; right, low ridge with reduced hill-slope and extensive pediment. Incised stream in middle distance*



*3. Mabanga Hill on right in distance. Bugombe Hill on left with hill-slope on cultivated pediment. Kiyanja Swamp in middle distance*

*4. Buganda landscape in late stage of the erosional cycle exhibiting coalescent pediments with slightly incised streams. About 7 miles north of Kampala*

by photographs, mostly grass-covered. They stress the importance of lubricated creep where the underlying bedrock is relatively impervious. Where gneissic and amphibolitic rocks have weathered to a kaolinitic clay (a common occurrence in Buganda) such a process of lubricated creep may well be important. The smooth ironstone pellets so abundant in the soil may also assist by acting as "ball-bearings." The important factor seems to be the nature of the evenly distributed rainfall preserving throughout the year a cover of vegetation which both retains the soil structure and reduces sheet- and rill-wash. This type of climate seems to be the cause of the relatively steep pediment as compared to those generally described. For instance, Fair has carried out a number of detailed surveys in South Africa on pediments and hill-slopes and expresses the opinion that in the sub-humid climate of Natal, "the pediment is essentially a slope of less than 5° over by far the greater part of its length.[1] In Southern Rhodesia, King (*op. cit.*) records an average of 3°. In eastern Uganda where rainfall in total is about the same as in Buganda but less evenly distributed, pediments average 3°.

It is difficult to estimate how quickly a topography will adapt itself to a change in climate. Uganda has been subject to a succession of important climatic changes since Tertiary times, towards the end of which it is believed that much of the present topography of Buganda was moulded. The change from a semi-arid to the present type of humid climate may be marked in the topography by a general steepening of the pediment and an advance upwards of the debris slope partly to envelope the free face of the "duricrust," as well as by the denudational and depositional features displayed by the valleys themselves.

ACKNOWLEDGEMENTS

This paper is published by permission of the Director of Geological Survey of Uganda, and grateful acknowledgements are also made to Dr. F. Dixey for his kindness in reading the typescript and offering some useful suggestions.

*Omission from map* (p. 83): The double hachures midway across the map, from east to west, do not represent alluvium but ridges controlled by bands of quarzite. This definition should have been included in the legend.

[1] *Trans. geol. Soc. S. Afr.* **51** (1949) 37–52.

# LONGITUDINAL PROFILES OF SOME GLACIAL OVERFLOW CHANNELS

C. R. TWIDALE

PROFESSOR R. F. PEEL[1] has directed the attention of geomorphologists to the peculiar longitudinal profiles of certain glacial overflow channels and it is the object of this paper to describe, and to attempt to explain, profiles found during a recent examination of late-Pleistocene features in north Lincolnshire.[2]

## THE PROFILES

Peel found in Northumberland that each of the two profiles examined in detail are of a "humped" or "up-and-down" form. The northern and southern slopes of the Beldon Cleugh channel are of almost equal length; peat fills a large depression at the crest of the hump, and various minor concavities occur on the northern slope. By contrast, the East Dipton channel possesses no complications in the way of peat accumulations but the eastern slope is much longer than the western.

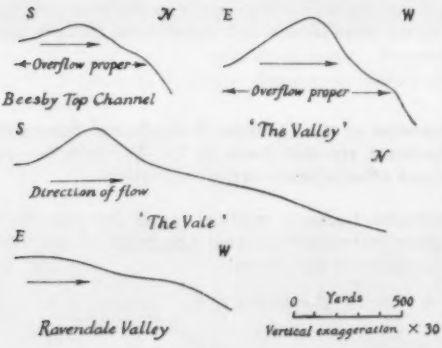



*Figure 1*

In north Lincolnshire the present writer has noted several glacial overflow channels with a humped profile. Only in a few places do sands and gravels mark the solid chalk in which the channels are eroded, and even here the debris is firmly considered to be essentially contemporaneous with the channel-cutting period. In no instance does such debris affect the general morphology of the spillways, and in particular it does not intrinsically contribute to the development of the humped longitudinal profile which is formed of a chalk surface and is thus a purely erosional feature. The channels are considered to have formed during the retreat of the ice with which the Hessle boulder-clay is associated (i.e. they are related to the most recent glaciation) and have been resolved into several series correlated with various positions of the ice front. The waters which excavated the channels flowed northward to the Kirmington valley and at least two earlier, higher level, stages overflowed westward through the Barnetby Gap, which breaches the Wold chalk escarpment, and into an extension of Lake Humber which occupied the Ancholme valley.[3] Of the channels, few were found to be suitable for levelling and various factors narrowed the possible choices to four: these were surveyed with a Dumpy level, with the results shown in Figure 1.

[1] Peel, R. F. "A study of two Northumbrian spillways." *Trans. Inst. Brit. Geogr.* **15** 1949 (1951) 73–89.

[2] Twidale, C. R. "Glacial overflow channels and related phenomena in north Lincolnshire." M.Sc. thesis 1952: Bristol University Library.

[3] Twidale, C. R., *op. cit.*, 1952; and C. R. Twidale "Glacial overflow channels in north Lincolnshire." *Trans. Inst. Brit. Geogr.* **22** (1956).

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It was decided that the Discovery Reports should be continued for the publication of further results of the Committee's work and other work arising therefrom which has been continued by the Institute. Since the data and collections are very extensive the reports will probably continue to be issued for some years; but since the work of the Institute covers a wider field it is expected that an increasing proportion of the biological results will be published through other channels and be included in the Collected Reprints, which are now issued annually. Although some biological papers have already appeared in them the majority of papers in the first three volumes of the Reprints are concerned with physical oceanography.

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*Cestodes of Whales and Dolphins from the Discovery Collections.* By S. MARKOWSKI. Pp. 377–395, Plates XX and XXI. 12*s.* 6*d.* net

*Cambridge: Printed at the University Press*

Each of the four channels displays the same characters in varying degrees; all possess a flat floor with a sharp break of slope between this and the relatively steep valley sides; all are only slightly curved in plan and constitute breaches of divides anomalous in terms of "normal" drainage development. As regards size, the Beesby Top channel is 450 yards long and 15 to 30 feet deep, "The Valley" 850 yards long and 25 to 30 feet deep, "The Vale" 1100 yards long and about 30 feet deep, and Ravendale Valley 400 yards long and 50 feet deep. A humped profile is present in all instances, but is more marked in some cases than in others; however, there are differences in detail as regards convexity or concavity of profile. There are no accumulations of peat in any of the depressions in the profile.

The Beesby Top overflow channel is concave upwards on both sides of a small but distinct hump though there is a very slight convexity below the 300 foot level on the northern slope. A similar slight convexity is displayed by the eastern slope of "The Valley," but once over the hump a marked and definite concavity can be seen. In "The Vale" the profile is concave on both sides of the hump. The last of the four, Ravendale Valley, shows neither concavity nor convexity on the eastern slope, and over a gentle hump the profile is first very slightly concave but attains a definite convexity just below the 150-foot level. In "The Vale" and Ravendale Valley the overall form of the hump is asymmetrical, one slope being much longer than the other, but in the other two the hump is nearer to the centre of the longitudinal profile of the channel, particularly in the case of "The Valley."

## SUGGESTED ORIGINS

When considering the possible modes of formation it should be remembered that these peculiar longitudinal profiles can originate in different ways; two modes of

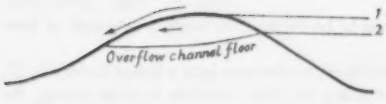



*Figure 2*

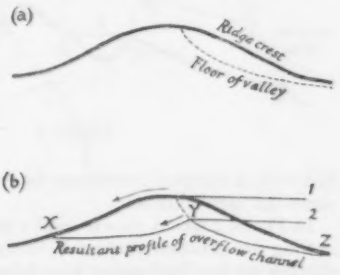



*Figure 3*

formation for the humped profile are discussed here. In the first case envisaged, the effect of pre-glacial drainage is significant in that one slope of the hump may be that of a pre-glacial valley; and in the second case, glacial overflow in reverse directions along the same channel at different stages of the late-glacial history is postulated. Other convexities and concavities may be explained in terms of oscillations of water level in pro-glacial lakes, without reversal of flow.

1. *Formation of humped profile assisted by pre-glacial drainage:* The theoretical mode of formation of an overflow channel is illustrated in Figure 2. Suppose that the pre-glacial ridge is narrowed and lowered by a stream working backwards by headward erosion, as in Figure 3 (a): such a lowering of the watershed would form a possible overflow outlet in glacial times. If overflow did occur, as in Figure 3 (b), at level 1, overflow channel cutting would lower the lake level and if proglacial lacustrine conditions expired at level 2, the profile X-Y-Z would remain. The portion Y-Z is that of the pre-glacial valley, while Y-X is that of the overflow channel, and the relative

lengths of the two slopes depend upon the duration and power of the overflow and the stage attained by the headward eroding stream. Channels formed in these circumstances differ from those formed as shown in Figure 2, in that the slope leading up to the hump is the floor of a pre-glacial valley cut back into the ridge.

Contour study reveals that such conditions obtained in several of the overflow channels found in north Lincolnshire, and "The Valley" (see profile 2 of Figure 1), located some 8 miles south-south-west of Grimsby, may be cited as an example: here the eastern slope is that of a pre-glacial stream. It differs from the trough-like, flat-bottomed transverse profile of the western slope postulated to have been cut as a result of glacial overflow in that it retains more nearly the U-shaped cross profile which is so characteristic of chalk valleys.

2. *Formation of humped profile by flow reversal:* Peel[1] suggested that reversal of flow down the same channel could account for the profiles found, and invoked movements of the ice front to give this effect: if the ice front shifted so that the lake which had previously overflowed was drained, whilst the previous receiving lake remained impounded, reversal of the flow would take place. Such situations may have occurred, but it is suggested that reversal of flow along the same channel can be effected in other circumstances.

When a proglacial lake overflows to an adjacent lake at a lower level it does so over the lowest available col which, manifestly, does not necessarily convey waters either to or directly toward an ice-free area. Thus, unless successive cols in a single general direction are at progressively lower levels some submergence of channels and amalgamation of lakes will occur; and if, subsequently, overflow takes place in a direction opposite to that previously followed, a humped profile may be expected to be formed by such a reversal of flow down the same channel.

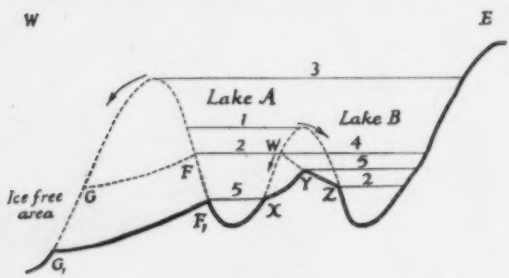



*Figure 4*

In Figure 4 lake A rises to level 1 and overflows to the east into a lower level lake B, cutting the overflow channel W–Z and reducing the lake level to 2 in so doing. As there is no low level outlet from lake B the water level rises until the channel W–Z becomes submerged beneath the combined lake A–B. Eventually level 3 is attained whereupon the waters of A–B flood over a ridge to the west to ice-free country; the ridge is trenched by the overflow channel G–F and as the depth of this feature increases so does the level of the combined lake fall. When the level 1 is re-attained, the ridge between A and B emerges, and when level 2 (=4 in lake B) is reached, the upper intake lip of the overflow channel W–Z again comes to light. Since the overflow channel G–F continues to be cut down the level of lake A continues to fall, but the level of lake B is held up by the lip at W, and so, since meltwaters continue to accumulate, overflow takes place from B to A, paring off the lip and reducing the lake levels to 5 when the profiles X–Y–Z and $G_1$–$F_1$ have been produced. The relative lengths of the two slopes of the humped profile depend on the duration of flow in each direction.

This account and diagram demonstrates that in certain circumstances reversal of flow can cause the formation of an up-and-down, or humped, longitudinal profile. For this to take place two circumstances must obtain: first, the cols leading from a

[1] Peel, R. F., *op. cit.*, p. 88.

series of valleys must not be all at successively lower levels; and secondly, the overflow channel of any particular series of channels which leads to an ice-free area or to a valley of large capacity must be incised to such an extent as to cause not only the re-emergence of drowned channels higher up in the series, but also overflow in higher members of the series in a direction converse to that previously operative. The first of these conditions widely obtains, but the second only when there has been sufficient time for the establishment of a coordinated and integrated system of overflow channels and pro-glacial lakes. No instance of a channel of such form and origin is known in north Lincolnshire, but the hypothesis is advanced for examination and testing by workers in other localities.

3. *Effect of changes of lake levels without reversal of flow:* It is suggested that changes in level of proglacial lakes can influence the form of the longitudinal profiles of overflow channels, not so much in general as in detail. Such effects are illustrated in Figures 5 and 6.

In Figure 5 the effect of a rise in level is shown and it can be seen that a break in

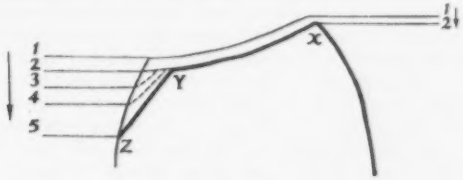



*Figure 5*

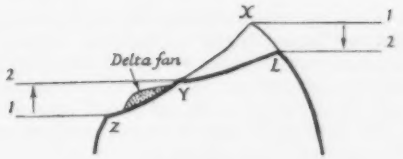



*Figure 6*

slope such as can be seen in the profiles of Figure 1 can be produced. A similar effect is shown in Figure 6 though for different reasons; in Figure 5 it is the upper part of the channel that is modified whilst the reverse is the case in Figure 6. The precise nature of the slopes depends upon rates of rise or fall of lake levels as well as upon hydraulic factors; thus, if the fall in level in Figure 6 is rapid, a profile convex upwards would tend to be produced whereas if the decrease is gentle the original concave profile might well be retained as the channel constantly adjusted itself to the shifting base-level.

The demonstration of such features and origins is complex. Among other things, it involves a consideration of the movement of ice fronts in different valleys, and an estimation of the volume capacity of various valleys at different postulated lake levels (e.g. for a given surface area and depth of lake a valley with concave sides will clearly possess a greater volume capacity than will one with convex slopes) in order to determine whether overflow from one ice-dammed marginal lake to another could have occurred, and whether lake levels were likely to be rising or falling, at a given stage of ice front retreat. However, the writer tentatively suggests that the lower part of the western slope of "The Valley" may have been cut by overflow waters proceeding

from the Beesby valley to the east into a lake, the level of which was gradually falling, which occupied the Wold Newton valley to the west.

All the profiles found and levelled in north Lincolnshire are considered to be explicable to terms of the effect of pre-glacial drainage on the longitudinal profiles of glacial overflow channels, but Peel's profiles cannot be understood in such terms. Even reversal of flow hardly explains the Beldon Cleugh profile satisfactorily, in view of its swamp filled depression situated at the very crest of the hump—unless, that is, some obscure turbulence effect is held responsible. Investigators of glacial overflow channels should bear in mind that humped profiles can arise in different ways and that the precise form (concave or convex) of their profiles may be related to oscillations of base level (lake level).

ACKNOWLEDGEMENTS

The writer wishes to acknowledge the invaluable help and encouragement received from Mr. J. N. Jennings of the Australian National University, Canberra, and from Mr. O. D. Kendall of the University of Bristol during the preparation of this paper.

# CHOGO LUNGMA GLACIER, KARAKORAM

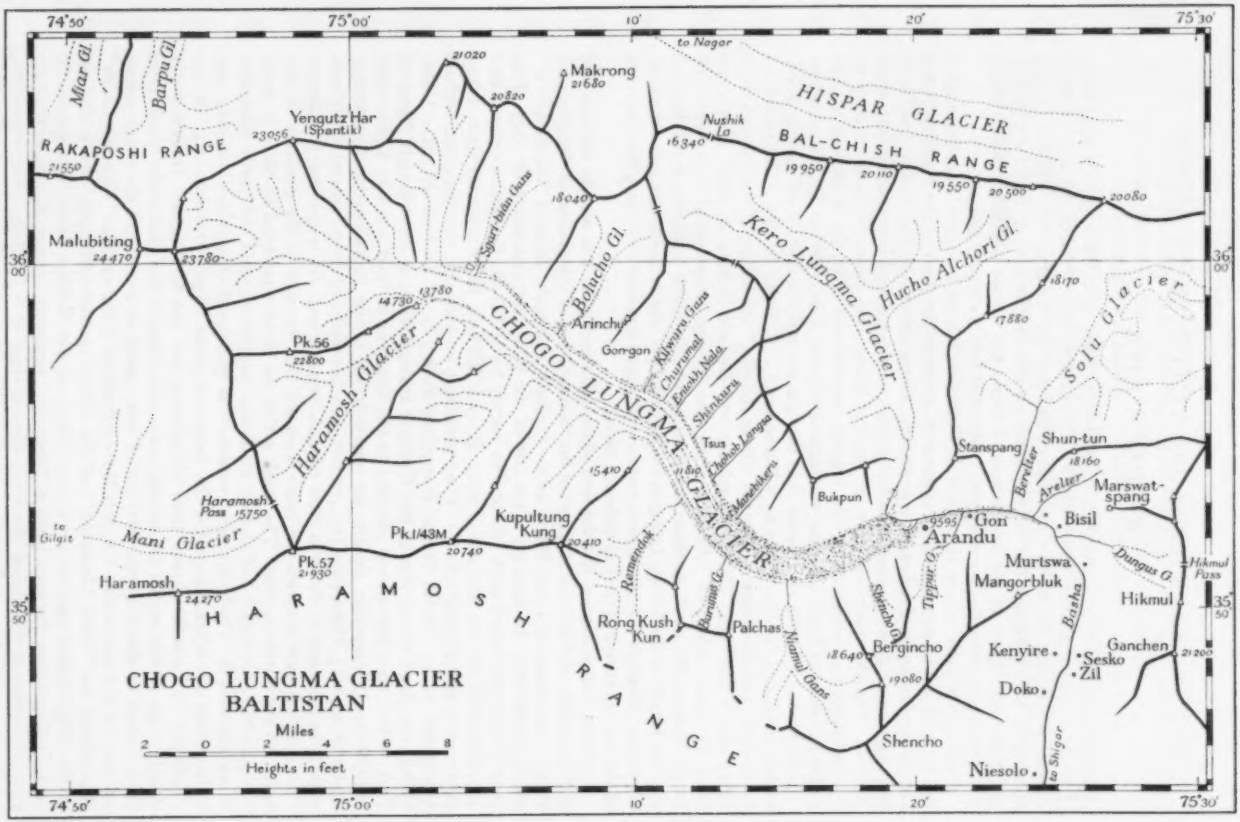
WILHELM KICK

I WAS EXPECTING in the autumn of 1954 to accompany as topographer the expedition of Dr. K. Herrligkoffer, which had for its objective Broad Peak in the upper Baltoro region. But during the summer months of that year the scientists of Professor Desio's successful K2 expedition had been at work on the Baltoro glacier, and I decided to go to another region of the Karakoram. I chose the Chogo Lungma glacier, which had only once before been investigated, and that half a century ago.

Although it is one of the very big valley-glaciers, Chogo Lungma is not situated in the zone of the main crest, but southwards at the bifurcation of the Rakaposhi and Haramosh ranges in the Lesser Karakoram. From Skardu on the Indus, itself only four days by air from Europe, the valley can now be reached by a further four days' journey. The ease and relatively low cost of access may promote more activity by mountaineers and scientists in this region: last summer a Frankfort Himalayan Expedition went to Chogo Lungma, accompanied by the meteorologist Dr. Untersteiner.

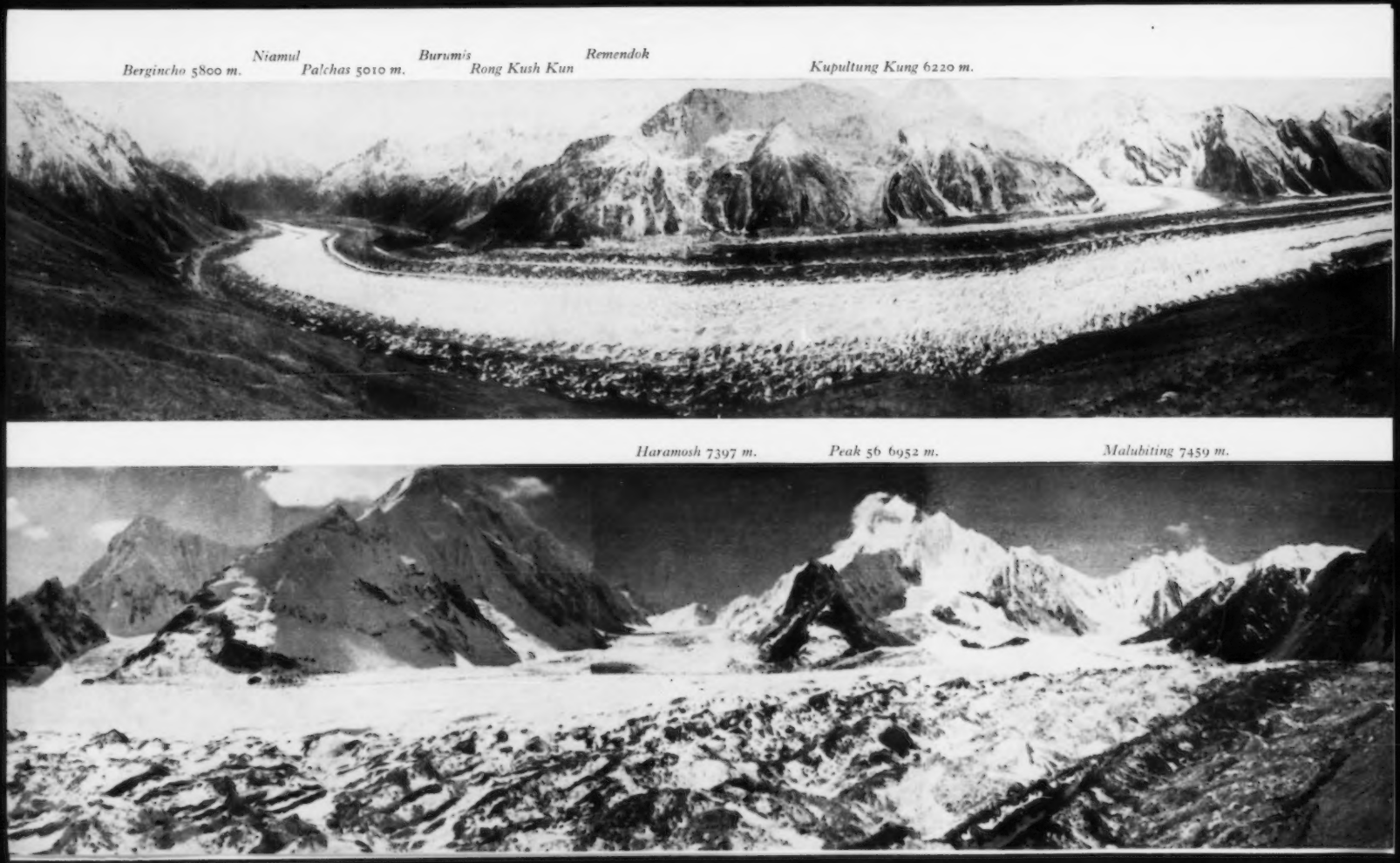
Easy access was also the reason that this glacier was the first of all the big Karakoram glaciers to be discovered by a European, G. T. Vigne in 1835.[1] He found the lower end "a short distance from the village Arindo," the height of the ice wall there being nearly 100 feet. The next explorer was Godwin Austen in 1861[2] who wrote from the small village of "Arundu at its (the 'Chogo Loombah's) termination, its fields touching the ice." As these statements are still roughly accurate, it would seem that the length of the Chogo Lungma has not changed much during the last 120 years. However, although the glacier may not have changed much in its length, the thickness of the ice has varied greatly at different times.

Godwin Austen carried out the first plane-table survey of this area in the space of only two days. But the result, a part of his "Sketch map of the glaciers of the Mustakh Range" on a scale of 1/506,880 (1 inch=8 miles), shows the form of "Chogo Ganse" much better than the map on 1/150,000 of the Workman expedition of 1903. This second map was based on a "theodolite survey by B. H. M. Hewett, corrected and supplemented by the authors (Fanny B. and William H. Workman) from actual observation and photographs."[7] They supposed, erroneously, that the given highest intersected point "Indus–Nagar–Watershed–Peak No. 2" (=Peak 46/42L=Malubiting) was fixed wrong during the Kashmir triangulation, as they thought Pyramid Peak, which they had almost climbed to the top, was at least 300 feet higher than Malubiting. Meanwhile, during the triangulation of the Indo-Russian Connection Series in 1912/13 Malubiting (24,470 feet) was checked and found correct and a new point was intersected: this was Peak 68/42L (23,056 feet) for which the Karakoram Conference Report suggests the name Yengutz Har, because of the glacier with this name on the northern side.[3] The peak which the Workmans tried to climb is really Yengutz Har. Oestreich had already made this suggestion,[4] and last year's triangulation confirmed it. The Workmans' mistake was quite understandable; it is very easy to be wildly out when comparing the height of peaks without instruments. In fact "Pyramid" is 1400 feet lower than Malubiting, not 300 feet higher. Indeed many sketch-maps of this region are wrong, some even make 2 *Siebentausender* (peaks over 7000 metres or about 23,000 feet) out of one, partly as a result of the many names existing for this mountain: Yengutz Har or Pyramid is the same as "Ghenish Chish" (Burushaski for "Gold Mountain") of the official quarter-inch map, and is the top of the ridge shown on Conway's map (1894) as the Golden Parri. The people of Arandu showed me the same peak as "Spantik," probably because of a highest single spot with grass at the foot of the south-eastern ridge of it (in Balti, *spang*=meadow, grass, *tik*=spot). If we follow the rule of the Karakoram Conference and call peaks,




*From a preliminary sketch by Wilhelm Kick, 1954*

*The end of Chogo Lungma glacier immediately before the village Arandu, without a terminal moraine*


Bergincho 5800 m.
Niamul
Palchas 5010 m.
Buruntis
Rong Kush Kun
Remendok
Kupultung Kung 6220 m.
Haramosh 7397 m.
Peak 56 6952 m.
Malubiting 7459 m.

like mountain groups, after the most accessible valley draining them, Spantik may be correct. On July 5, this peak was climbed by three members of the Frankfort expedition.

The Workmans' map is inaccurate in other respects too. It shows for instance the whole Chogo Lungma running straight down to Arandu, whereas in reality the ice stream curves upwards some miles from its end at an angle of almost 90 degrees. Unhappily the Survey of India has replaced the hitherto roughly correct representation in the official map (transferred from sheet 27 (A) N.E. of the Atlas of India and thus based on Austen's survey) by that of Workman, and has thus made it worse. Oestreich, who "was to act as topographer" during the Workman expedition of 1902, had already mentioned this mistake of the map of 1903 in his report[4] and he published a map on 1/200,000, which shows the right form at least in this respect.

It was Oestreich who observed on Chogo Lungma for the first time the "Randschluchten," those ravines between glacier ice and mountain slope, caused by reflection of sun-rays, which were later on, when dealing with other Karakoram glaciers, described as ablation valleys (Visser).

In 1863 or 1870 Frederick Drew went up the Chogo Lungma for some 15 miles.[9] On 15 December 1913 the Italian geologist G. Dainelli visited the snout of the glacier for some hours.[10] Its front showed an advancing tendency, but this cannot have been for long. In 1954 it could easily be seen that the glacier's surface must have been shrinking for some decades. In 1939 Dr. E. C. Fountaine of Shipton's expedition[5] and in 1947 the Swiss H. Gyr and R. Kappeler [6] saw the Chogo Lungma only for a very short time, crossing the Haramosh La.

During October 1954 I triangulated and made a stereophotogrammetric survey on Chogo Lungma glacier. The Survey of Pakistan sent a surveyor, Sahib Shah, with me, who proved most helpful. He made a plane-table survey on 1/168,960 (1·5 inches =4 miles) The triangulation with a Wild T2 and the photogrammetric standlines could be referred to six intersected G.T. points round the upper part of the basin and to Ganchen in the east. Finsterwalder's light photo-theodolite TAF 13 : 18 cm. =5·1 : 7·1 inches proved again as well qualified. The eighty plates photographed on seventeen standlines are not sufficient to map the whole region, but they are enough to construct an essential part at the stereoautograph in the final position within the grid net.

The main glacier is accompanied on both sides almost everywhere by a big, young, marginal moraine, whose ridge is on an average 80–200 feet over the surface of the ice, and which reminds one strikingly of the known "1850" moraine of the Alps. A shepherds' path runs behind this moraine in a "border valley"—sometimes too broad to be described as an ablation valley—often over the plain sediments of ancient lakes, of which a great number still existed in 1902/03. The reason for their drying is the shrinking of the glacier surface, which drains this border valley more and more actively.

If one compares all the satements made by Vigne 1835, Godwin Austen 1861, the Workmans and Oestreich 1902/03, Dainelli 1913, with the observations of 1954, the result is briefly as follows. The Chogo Lungma glacier was advancing in 1835, and had been doing so for some time. It was advancing in 1861 and must have reached its maximum, which caused the big moraine some years later. In 1902 it had begun to retreat, though probably it had not been retreating for long, and it was still retreating in 1954, with an interruption about 1913. In other words, the variations of the Chogo Lungma glacier show roughly the same *secular* curve as those of the glaciers of the Alps, though not without superimpositions by unknown secondary smaller variations. For the big secular line there is no statement which would contradict a parallelization of the glacial variation in the Chogo Lungma region (the 14 side glaciers and the Tippur show, roughly speaking, the same curve within the last 52 years) with that of the Alps over the last 120 years. It may be that the maximum was not in the middle, but in the last third of the nineteenth century. The result for Chogo Lungma

*Above: Chogo Lungma ice-stream, flowing down from right to left, with typical marginal moraines from nineteenth century maximum*

*Below: Three of the six upper intersected points*

is of a special importance; this big Karakoram glacier (not 30 or 34, but 28 miles) seems to offer a good opportunity of studying the phenomena of glacial variation in the Karakoram, even better than Biafo and Baltoro, because of the early reports and the valuable descriptions by Austen and the glaciologist Oestreich, who made a theodolite survey of the lower tongue in 1/10,000 as early as 1902, which can be compared now with the photogrammetric survey of 1954, and because of the very good conservation of the different moraines.

The inhabitants of Arandu tell of the outbreak of a glacier lake between 1915 and 1920, which destroyed some fifteen houses of their village and a part of their fields, which now lie buried for ever under stones. The floods came from a lake dammed up at the mouth of Niamul *nullah*, or from that big hole ("Doline," the ice broken down as in a Karst landscape), within the ice body at the right margin of the glacier, which Oestreich described in detail in 1902.

Besides two young Baltis, the *lambardar* of Arandu (whose dignity passes by hereditary right) accompanied me all the time, telling me the geographical names of the pasture places, *nullahs* and peaks, and helping to find the meaning of some of them. Thus some three dozen names of the region were collected and will be fixed on the map. The geographical names used by the Arandu people are for the most part of Balti origin, the most western dialect of Tibetan. But some must be derived from another language, perhaps similar to the Burushaski of the neighbouring Hunza and Nagar people. Whether this people once lived here in the Basha valley or whether parts of their language and these names go back to a Munda language, is an open question. I have to thank the British missionaries the Rev. R. Bavington and the Rev. A. F. C. Read, the only Europeans who have lived for many years among the Baltis, for helping to find the meaning of some names, also Lt.-Col. D. L. R. Lorimer, the Burushaski expert, and Professor Tucci, Rome, the well known Tibetan explorer, for similar assistance.

While travelling from Skardu to Arandu I found Muslim customs followed more severely now than fifty years ago. The reports of the Workmans about pigs and pigsties in the Basha villages—without showing any astonishment at this fact!—may be wrong. But their account of the "chief women" of Arandu, who brought presents to the camp, is proved by some photographs of these women. Today such women do not exist in Arandu. It may have been in 1902 still one more relict of Buddhist times. Last year the women fled crying when a strange man came. And the *lambardar* of this last village, who wanted to invite me to meet his family (he has already sent away two wives and now is married to a third, a fifteen-year-old, who gave birth to her second child whilst the *lambardar* was on the glacier with us) was not allowed to do so by the *mullah*. The cause of this change of customs may perhaps be sought in the action of certain Persian 'Shia leaders some fifteen years ago, who invited several hundred young Baltis and trained them as Molvies (Muslim religious teachers) for the villages of Baltistan. The development, which Biddulph [8] found already more than seventy years ago for the Dardu and Hunza people, that Islam is "increasing annually in its vigour" (retranslated from my German notes) has grown still stronger since Biddulph's days.

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# FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING EXTRACT is taken from the account of the presentation of the Royal Awards on 26 May 1856, published in the *Journal of the Royal Geographical Society*, Vol. 26, pp. clxvi–clxvii.

HIS EXCELLENCY G. M. DALLAS. Minister of the United States of America, having consented to receive the Gold Medal awarded to Dr. Kane, the President [Rear Admiral F. W. Beechey] addressed him as follows:—

"Sir,—The Founder's Gold Medal, the highest honour this Society has in its power to bestow, has been awarded to Dr. Kane, of the United States of America, for his distinguished services and important discoveries in the Polar regions, while in charge of the expedition fitted out in America to search for Sir John Franklin; and for his valuable Memoir and Charts, communicated through the Admiralty.

"In the absence of Dr. Kane himself, I could desire no greater privilege than that of confiding the award, Dr. Kane has so justly deserved, to the hands of the distinguished representative of the nation to which he belongs; in order that the feeling of this Society, and I may say of the country at large, may go forth in its fullest extent to the land which enrols the name of Dr. Kane among her citizens. Sir, I cannot discharge this duty without passing a remark on the peculiarity of the circumstances attending this occasion.

"It seldom happens that nations so distantly situated, spontaneously unite in such acts of humanity as those which have characterized the late search for Sir J. Franklin. More rarely still do we find the sympathies of individuals so enlisted in the fate of foreigners, as to manifest themselves in acts of philanthropy of such a truly liberal and substantial character as have here occurred; and this act of the United States, together with the names of Grinnell and Peabody, will long be remembered in this country, even after the spirit of Arctic enterprise shall have passed away. But, Sir, if the feelings of *nations* have been deeply enlisted in this search, how much more so must have been the feelings of *individuals*, who enjoyed the friendship of the object of it? Sir, there are persons now present who were early associated with our lamented countryman, who shared with him his first perilous encounter with that icy element which was afterwards to become his tomb, and who enjoyed his friendship through life.

" As one of these, you may imagine that it is with no small degree of interest that I find myself now, in my official capacity, conveying this award of the Society, to the officer who so strenuously endeavoured to determine the fate of him, whom we all so deeply deplore.

"These sympathies, however, have had no share in the decision of the Council. Dr. Kane's merits alone, have won for him this testimony of the Society; and I trust that these reciprocal acts of good feeling between nations and individuals may tend to bind in lasting ties of amity these two great nations, whose sympathies have been shown to be so closely identified."

His Excellency the American Minister, having received the Medal, replied:—

"Mr. President,—On behalf of my fellow-citizen, Dr. Elisha Kent Kane, I receive, with equal pride and pleasure, this testimonial, awarded by your learned body, to his ability and services in that branch of human knowledge, to which you are specially devoted. . . .

"Dr. Kane, as is personally known to me, entered upon his career of Arctic exploration under the influence of sentiments which were strengthened, rather than shaken, by its depicted terrors. In the medical department of the navy of the United States, on a remote station, his Government scarcely intimated a disposition to join in the

search for Sir John Franklin, before he hurried forward to volunteer an enlistment for that noble purpose. There was a voice upon the breeze that had caught his ear; an ardent fondness for scientific studies impelled him to a fresh field of research; a daring and irrepressible spirit of enterprise co-operated with much experience and peculiar attainments.

## ECONOMIC GEOGRAPHY AND THE LOCATION PROBLEM

THE ECONOMICS OF LOCATION. By AUGUST LÖSCH, translated from the second revised edition by William H. Woglom and Wolfgang F. Stolper. *New Haven: Yale University Press; London: Geoffrey Cumberlege, O.U.P.*, 1954. 9½×6 *inches;* xviii+520 *pages; diagrams.* 60s

"GEOGRAPHERS have been as active in adopting the term 'economic' without doing much distinctive with it as economists have been inactive in using the term 'geography' for their basic data." Lord Stamp's words are from a Presidential Address in which he surveyed the relationships of geography and economic theory and drew attention to the gap between them, inadequately filled from either standpoint.[1] Lösch's work, sub-titled "a pioneer book in the relations between economic goods and geography" and concerned as it is with the economics of space, represents a major step into the no man's land between the two subjects, and as such is of great interest to the economic geographer.

August Lösch, a member of the Institute for World Economy at Kiel, produced this book in 1939; it reappeared in a revised edition in 1943, and it is the revised edition that Woglom and Stolper have ably and thoroughly translated. Lösch himself died shortly after the end of hostilities in 1945, not least, as the author of a memorial note observes, "as the result of that very strength of character which forbade him any compromises with the National Socialist regime." He was still not forty years of age. Lösch had set himself to make an original contribution to economic theory, to ask and answer the question of how the economy fits into space; his book has already become a classic.

'The economics of location' is divided into four sections entitled, successively, Location, Economic Regions, Trade and, finally, Examples. It was to the last section that the author drew the attention of geographers; in fact, the second section proves of equal interest and greater stimulus. Part One, Location, is devoted to an analysis of the location problem as applied to industry, agriculture and towns, and forms an introduction to the whole book. The findings of earlier workers, notably Alfred Weber, are critically reviewed and their contributions to traditional location theory assessed. For Lösch, their partial solutions, that assumed as given the location of raw materials and markets, offered only the challenge to the development of a general equilibrium approach and, accordingly, he outlines the conditions of general equilibrium for individual industrial enterprises, farms, towns and (to use his term) "economic belts." Lösch recognized, as does economic geography, the distinctiveness of the problems attaching to agricultural and industrial distributions. There is an interesting discussion on the causes of the formation of economic belts.

But it is in Part Two, Economic Regions, that the most original contribution is to be found. The theory of economic regions is developed as a link between the theory of individual locations and that of location patterns as a whole. At first Lösch shows how, even under homogeneous conditions, spatial differences in economy would arise

[1] *Geography*, **22** (1937) 5.

through the operation of economic forces. Market areas are shown to develop around every centre of production in the form of a regular hexagon. For every group of products a net of market areas is found and a systematic arrangement of the various nets may be distinguished. Through this analysis Lösch derives the ideal type of an "economic landscape" or region "distributed throughout the world like a network, and in accordance with regular laws." Lösch then considers at length the effects of changes from the originally assumed ideal conditions, including, for example, the effects of geographic price policies, freight rates, transport costs and natural conditions. The frequency of variation in natural circumstances, he remarks, has led many to "despair of any spatial economic pattern. The irregularities of nature do indeed interrupt the uniform development of (economic) landscapes. But they need not destroy it entirely since all the organizing forces combine against the separate chaotic ones." The discussion of the effects of local differences in accessibility and of natural obstacles is of obvious geographical interest. The effects of human differences, among individuals and societies, are also considered. Clearly, under the impact of actual conditions, the uniformity and regularity of the ideal network is to some extent lost. The market areas are arranged no longer in an ideal network, but overlap like "an irregular layer of pieces of slate carelessly flung down." But the essential qualities of a network remain; amid "all the chaos of reality, a basic pattern of economic districts is nevertheless unmistakeable." This is a triumphant conclusion. Though the spatial economic pattern contains irregular features, the emphasis is not on lack of order. The location of economic activities is seen as an orderly process, with basic patterns arising as the result of identifiable forces. This is the principal message of this book to the economic geographer: within the bewildering variety and individuality of places and events in space order may be distinguished, and apparent chaos is but order in disguise. The section is long, the reasoning close and often difficult, but the economic geographer will do well to peruse it with attention.

Part Three, a little misleadingly entitled Trade, places the problem of location within the broader context of the occupational and spatial division of labour. The geographer will find reward in following the economist's approach into problems of population and industrial distribution. There are occasions, as on reading pp. 255 *et seq.*, when new possibilities of closing the gap between economic theory and geography can be visualized. The economist is here concerned to understand "space-conditioned particularity"; spatial differences become a problem in economics as they have always been in geography. Not all this section is of equal geographical interest, though there is a valuable discussion of the effects of geographical price differences and of price waves that appears to mark a distinct advance in economic thinking. Lösch's critical approach to the classical theory of international trade, or at any rate to the employment of that theory, should also be noted.

The examples in Part Four should not be taken simply as verification of the theories developed earlier in the book. They have been chosen, says Lösch, not to prove the theories but to test "whether reality is rational." Through his case studies, drawn mainly from the United States of America, which the author twice visited and which he found, for obvious reasons, a grand laboratory for his spatial conception of economics, Lösch reinforces the lessons of his Part Two. "I have attempted," he writes, "more to suggest how strong the forces of order really are than to intensify, by enumerating contradictory cases, the discouraging impression of chaos under which we have suffered too long."

This is not, it should be re-emphasized, a text-book in economic geography. It represents the reasoned attempt of an economic theorist to provide a basic framework of theory for the investigation and explanation of spatial differences in economic activity. It is a beginning, an opening of a new field, not an end; it represents an approach, from the other side as it were, to cross the gulf between the two sciences of economics and geography. Lösch's work will prompt economic geographers to reconsider the position of their own discipline in relation to the location problem and to

consider how far, if at all, they are in a position to contribute to the crossing of the gulf. Already different attitudes exist. Professor Wilfred Smith had, apparently, little doubt that the general subject of the location of economic activity lies within the field of economic activity. The full objective of economic geography, he wrote, "is to lay bare the rationale of economic distributions." [1] It is fitting to add that the untimely death of Wilfred Smith has taken from us a guide more fitted, perhaps, than any other to lead the subject in its new tasks. Smith, though approaching from a very different viewpoint, saw, like Lösch, order within the "rich and complicated fabric" of economic distributions.[2] On the other hand, Hartshorne has illumined the danger that in investigating economic distributions for their own sake, the study may cease to be economic geography and become only a study in the geographical aspects of economics.[3] If the burden of Hartshorne's argument, closely and logically reasoned as it is, may be disappointing to the geographer contemplating entry into the study of the location problem, he does at least yield that geography has some role to play in providing both "positive materials and effective criticism." [4] This is not an occasion to judge or arbitrate between these approaches, neither can the full role of economic geography be assessed in a few lines. It is clear that there is still a no man's land between the respective studies of economics and economic geography. The gulf to which Lord Stamp referred has still to be filled. Contributions are being made from both sides and only experience can show where the frontier will eventually lie.

'The economics of location' represents a major contribution. Though not a geography book, it will prompt and stimulate thought in the border-lands of economic geography. Whether or not the individual economic geographer regards the location of economic activities as a part of his field, he will do well, if he is to contribute to the development of his subject, to read this book and mark its lessons. M. J WISE

## STUART MAP ENGRAVING

ENGRAVING IN ENGLAND IN THE SIXTEENTH & SEVENTEENTH CENTURIES: a descriptive catalogue with introductions. By ARTHUR M. HIND. Part II: The Reign of James I. *Cambridge: University Press*, 1955. 9¾×7 *inches;* xxxii+413 *pages;* 252 *plates.* £6 10*s*

THE INTEREST of Dr. Hind's generously planned catalogue for the history of cartography in this country was noticed in the review of Part I (*Geogr. J.* **118** (1952) 489–91). Under the Stuarts the unity of the arts, so remarkably exemplified in the work of Elizabethan craftsmen, is less noticeable; and the emergence of the commercial printseller, soon after 1600, was accompanied by that of the professional engraver working with great fertility from a wide variety of subjects. While many chapters of Dr. Hind's Tudor volume described engravers' output, or groups of engravings, wholly cartographic in character, in his Jacobean volume we have to seek maps and topographic views among the varied *oeuvre* of engravers whose work might include portraits, title plates and book illustrations, heraldic designs, emblems, and music. In this period, indeed, "portrait offered by far the largest field for the engraver's activity," and the new volume gives detailed accounts of the two splendid collections of portrait plates edited by Henry Holland, *Basiliwgia* (1618) and *Herwologia* (1620).

The reign of James I produced no map work comparable in originality to the

[1] "Geography and the location of industry, An inaugural lecture," 1952, p. 3.
[2] *Ibid.* p. 20.
[3] Hartshorne, R. 'The nature of geography,' Lancaster, Penn Assoc. of American Geographers, 1939, pp. 415 *et seq.*
[4] *Ibid.* p. 420.

county surveys of Saxton and Norden or the Wright-Hakluyt world map; and Dr. Hind is rightly more severe in his selection of cartographic material for description and illustration. Yet the expanded output of the seventeenth century engravers, stimulated by a far wider market than Tudor patronage could offer, became an effective instrument for the popular diffusion of geographical ideas, and we may be grateful for a work of reference which sets out with authority and precision the successive states and editions in which contemporary English maps and atlases reached their public. Among the important topographic material here described are the county maps engraved by William Kip and William Hole in Camden's 'Britannia' (1607), Hole's emblematic county maps in Drayton's 'Poly-Olbion,' the maps engraved by Renold Elstrack and others in 'Purchas his Pilgrimes,' Captain John Smith's maps of Virginia and New England, the earliest of the seventeenth century "long views" of London (that by C. J. Visscher and the anonymous view from the north), and the maps of John Speed engraved at Amsterdam for his 'Theatre' (by Hondius) and 'Prospect' (by Abraham Goos and others).

The continued superiority of the Netherlands in map engraving is illustrated by the fact that (after the death of William Rogers, who seems to have begun the work) Speed, perhaps on Camden's advice, sent his county maps to the workshop of Hondius. Speed—no surveyor, although some fifty of his town plans may reasonably be considered his original work—was an energetic compiler, and in Hondius he found a master-engraver with unusual skill in combining into a harmonious composition the miscellaneous "copy"—maps by Saxton or Norden, town plans, drawings of buildings, figures, or antiquities, rubbings of coins, and much else—that he received from Speed. It is unfortunate that, while the late Dr. Eric Gardner's work on the Speed-Hondius maps remains unpublished, no detailed study of them is yet available; and the thirty pages, based in part on Dr. Gardner's notes, that Dr. Hind devotes to them provide a welcome guide to the earlier history of these plates, which remained in use for over a century and a half. A few omissions may be mentioned. The successive settings of the text, which Dr. Hind barely notices, illuminate the history of the plates; it is curious to find, in his list of editions of the 'Theatre,' no reference to that of Rea (1665), in which, with a reset text, the map plates are published in a new state with alterations in the imprints and place-names. We must also regret that the author could not find space for fuller indication of the sources of those town-plans derived by Speed from others. The following omissions or corrections may be mentioned: Richmond (Surrey), from a drawing by A. van Wyngaerde; Exeter, from the engraving by R. Hogenberg (1587); Windsor, from the engraving in 'Civitates orbis terrarum,' II (1575), after Hoefnagel; Norwich, from William Smith's drawing (Sloane MS. 2596) after W. Cuningham; Cambridge, from John Hammond's plan engraved by Ryther (1592)—not after Lyne's plan; Oxford, from the plan by Agas engraved in 1588; Chester, from William Smith's drawing (Harl. MS. 1046); Pembroke and St. David's, both signed "Shewed in due form as they were taken by John Speed"; Carlisle, Berwick, Edinburgh and "Enis Kelling Fort," from drawings in the Cotton MSS. (Aug. I. i. 13, ii. 14, ii. 56, ii. 39). Eight of Speed's town-plans were copied in the sixth volume (1615) of 'Civitates orbis terrarum.'

Dr. Hind's account of the Kip-Hole county maps in the Latin edition (1607) of Camden's 'Britannia' needs to be supplemented by reference to the two English editions (of 1610 and 1637), in which these maps are found in three different states. To his documentation may be added Edward Lynam's study of Woutneel's map of the British Isles of 1603 (*Geogr. J.* 81 (1933) 536–8) and Miss I. Scouloudi's 'Panoramic Views of London 1600–1666' (1953).

This comprehensive and scholarly volume is completed by a list of corrections and additions to Part I (many of which relate to cartographic items) and by a fine series of 252 half-tone plates.

R. A. SKELTON

# THE VOYAGE OF THE *ENDEAVOUR*

THE JOURNALS OF CAPTAIN COOK ON HIS VOYAGES OF DISCOVERY. I. The voyage of the *Endeavour* 1768–1771. Edited by J. C. BEAGLEHOLE. *Cambridge: for the Hakluyt Society at the University Press*, 1955. $9\frac{1}{2} \times 6$ *inches;* clxxxiv +684 *pages; frontispiece in colour; illustrations and maps.* 80s

CHARTS AND VIEWS DRAWN BY COOK AND HIS OFFICERS AND REPRODUCED FROM THE ORIGINAL MANUSCRIPTS. Edited by R. A. SKELTON. *Cambridge: for the Hakluyt Society at the University Press*, 1955. *Portfolio*, $15\frac{1}{2} \times 10\frac{1}{4}$ *inches, containing* 58 *plates.* 50s

THE ACHIEVEMENTS of Captain James Cook as an explorer and hydrographic surveyor are now widely appreciated, and he has been the subject of numerous biographies. It is therefore at first sight odd that until the present his own journals have not been adequately edited and published. His first voyage is known from the version compiled officially by Dr. Hawkesworth, which, though it has its merits, is not Cook's handiwork, and from the edition of his Journal by Admiral Wharton, which does not come up to modern editorial standards. It is fair to say also that few of the biographies are of the quality appropriate to a man of his pre-eminence. These two circumstances are clearly related to each other; the material covering the three voyages is considerable, and moreover widely scattered in libraries throughout the world. In present conditions, research and publication costs would rule out the individual editor or author seeking to do justice to Captain Cook. It is fortunate, therefore, that the Hakluyt Society has found not only the scholars with the requisite expert knowledge, training and enthusiasm to tackle the ambitious project of publishing what must become the standard text of Cook's Journals, with supplementary material and critical apparatus, but have received the enlightened support of the New Zealand Government, the Pilgrim Trust and Mr. Esmond de Beer and his sisters in producing the work adequately.

The text of the Journal printed in Volume I, "The Voyage of the *Endeavour* 1768–71," is from the Canberra MS., the sole copy in Cook's holograph. This is a fair copy, probably completed before he reached Batavia, but apart from the Log, it is as close as it is possible to get to the events of the voyage as they appeared to him at the time. Cook is an erratic speller and his grammar is often shaky, but he knows what he wants to say and says it plainly, and not seldom memorably. To read it is to get very close to the man. In printing the text, Cook's spelling has been followed, and in most cases his capitalization; his punctuation is sparing, and has been amended while attempting to retain the "feeling" of the text. Dr. Beaglehole, the editor, has annotated the text liberally with important variant readings, notes on the ship's track, identification of native place-names and historical and biographical information.

There can be, of course, no surprises, but in this form the Journal makes excellent reading. Cook is generally matter of fact and does not write up the big moments; nevertheless he imparts the sense of urgency and strain on critical occasions. His narrative of the navigation of the Great Barrier Reef is writing of the first class. Even allowing for some use of Banks' notes, he also shows wide interests for one with his circumscribed upbringing, and his observations on native ways are shrewd and often penetrating. In addition, Dr. Beaglehole has contributed a lively sketch of the exploration of the Pacific to 1780, which puts Cook's work in perspective. In his eyes, Cook can scarcely do anything wrong, and his success seems predestined. Beaglehole is certainly able to show that the requirements for a successful explorer of the Pacific Ocean were all united in Cook; readiness to break away from the well-beaten track, and at the same time skill for inshore work; accuracy in dead reckoning; realization of the necessity for a well chosen base for operations in the Pacific; attention to

naval hygiene and the prevention of scurvy, and understanding of the reasons for the successes and failures of his forerunners. At the same time, Beaglehole gives due credit to men like Samuel Wallis and Philip Carteret. His essay is a stimulating introduction to Pacific exploration, but inevitably it touches on topics which could be pursued further. The historical cartography of New Guinea and the question of how far the existence of Torres Strait was known have still some aspects to be cleared up. To this wealth of material there are added appendices which include transcriptions of Cook's letters and report on the voyage, extracts from Journals kept by others, and a calendar of documents. The index prepared by Marcel Aurousseau is a model of its kind.

The volume is furnished with numerous reproductions in half-tone or line and with folding maps of the *Endeavour's* track, not always very conveniently placed for using with the text. The portfolio, edited by Mr. R. A. Skelton, contains reproductions of original manuscript charts and views from the three voyages, fifty-eight in all, the majority being in the British Museum. Of those relating to the first voyage, all, with the exception of three plans by Pickersgill and a view by H. D. Spöring, one of Banks' assistants, are by, or attributed to, Cook himself, further testimony to his constant activity and absorption in his task.

In addition to editing this portfolio, it is an open secret that to Mr. Skelton, next to Professor Beaglehole, must go credit for carrying out the whole work. They have certainly placed geographers and historians deeply in their debt. Messrs. Maclehose have achieved a notable success in tackling so effectively a large and complicated piece of printing.

G. R. CRONE

# REVIEWS

## EUROPE

GLOUCESTERSHIRE. By H. P. R. FINBERG. LANCASHIRE. By R. MILLWARD. (The making of the English landscape: Edited by W. G. Hoskins.) *London: Hodder and Stoughton*, 1955. *Each* 9×7 *inches; 128 pages; maps and illustrations.* 16*s*

These two volumes are recent additions to the series edited by W. G. Hoskins which aims at explaining the origins of everything visible in the English landscape. As in the earlier books of this series, the texts are copiously illustrated, and comprise valuable additions to the literature of English geography.

The Gloucestershire volume is, in the author's own words, just an outline of how the county came to wear its present aspect. Nevertheless it is a good outline, sufficiently readable to attract the general reader, and at the same time sound enough to serve the serious student of landscape whose local knowledge of this particular county is not great. The book can be criticized primarily on two issues. Mr. Finberg points out the existence of three separate landscapes corresponding to the three physical divisions of the county, but then, in sticking too closely to a chronological treatment, produces a first-class narrative only at the expense of adequate explanation of many landscape features. His work therefore tends to be a history of the county as it affects the landscape, rather than an account of the landscape itself.

The second major criticism is concerned with the question of over-simplification. The origins of many landscape features are not so clear-cut as might appear from reading this book. Only once does the author give a footnote reference to alternative theories, and recent research of which he must be aware is largely ignored. A reader well informed on the general processes of landscape evolution, using this book as an

introduction to a particular area, can easily allow for any defects in this direction, but the general reader or anyone being introduced to the subject as a whole. might well learn much which will have to be discounted as he proceeds. This brings up the whole question of the relationship between what is written in books and what is written in the journals of learned societies. It is worthy of more consideration than can be given here, but it is mentioned because this book and its companion volumes have much to offer to a wide audience—they can therefore be tantalizingly inadequate with some justification, but they should not mislead.

The treatment of the Lancashire volume is quite different. Three clear-cut sections deal respectively with the countryside, the towns and the communications, and the result from a geographical point of view is much more satisfactory. Mr. Millward has made a special point of dealing with more than the Pendle Witches and the Lancashire Lake District. His accounts of the Mosslands, Morecambe Bay, the Fylde and Bowland, added to those of the better known Furness and industrial districts, amount to a fairly complete coverage of the county scene. In particular he has not forgotten that Lancashire has a large area of grime and unsurpassed ugliness. Unfortunately, however, he seems to have been at pains to point out the worst in the industrial scene. His picture of the south-east is essentially that seen from the train. It is real and should not be ignored, but neither should those many pockets of country similar to that near Longridge which the author describes. Here are surprisingly mellowed landscapes intermingled with the grime, relics of the pre-industrial days which do not affect the overall picture, but which are well known to twelve million people who might like to know more of what the county was like prior to the ravagings of that type of expansion which they are now consciously trying to avoid.

This book not only describes—it attempts to explain, even to the extent of forecasting an end to any major developments in the Lancashire landscape. In the opinion of this reviewer, the author has misunderstood the reasons for the change in tempo, and misinterpreted the significance of the few recent developments. But in even hinting at man's motives this book is on the right lines. N. H.

THE CANALS OF SOUTHERN ENGLAND. By C. HADFIELD. *London: Phoenix House*, 1955. 8½×5½ *inches;* 381 *pages; maps and plates.* 36*s*

Charles Hadfield, already known for his volume on British canals, has in this work amplified the story of canals and waterways of England south of a line from the Thames, by the Thames and Severn and the Gloucester and Berkeley Canals, to Gloucester. At first glance the arrangement of the book seems curious in that the story of any one navigation is split into different chapters according to the periods of before the canal mania, the golden age of canals, and after the advent of railway competition. Thus the account of any one navigation may be found in three widely separated sections: for example, the story of the Exeter Canal is dealt with in chapters II, X and XIV. Nevertheless the author has succeeded in grouping a great mass of information in a manner which preserves the thread of the evolutionary story.

In southern England most of the canals were financial failures and, struggling against the paucity of traffic potential, the engineer was handicapped in providing a routeway for he could not afford to plan great aqueducts such as were justified in the north. Again, while the relief was relatively low the grain of the country was frequently across the projected line and, despite the need to economize, four tunnels of over a mile in length had to be bored to accommodate southern canals. Regions where the traffic potential seemed to warrant the provision of capital were the south-west peninsula and the country between the navigable Thames and Severn. For two generations after 1769 scheme after scheme was proposed to join the English and Bristol Channels and thereby avoid the stormy passage, which was also liable to delays from headwinds, round Land's End. The advent of the railway prevented any scheme coming to fruition.

No one interested in the development of southern England during the last two

centuries can fail to enjoy some part of this volume. It is a mine of information, often drawn from little known sources such as local newspapers, broadsheets and the minute books of the canal proprietors, and it throws a new light on the pattern of canal use and disuse. Too frequently the railway companies have been accused of purchasing the canal companies in order to strangle competition and the evidence from this volume shows how unreal the accusation has often been. The railway companies did try to buy canals of competitive value but even when the canal concern was left alone it fell into decay, unless there were special reasons for traffic continuing to use the waterway; against the more speedy service of the rail the canal boat could rarely compete. As Mr. Hadfield shows in this account, which is well illustrated and supported by useful appendices, even though most of the canals have lost their value and have frequently disappeared from the landscape, they were responsible for much of the economic development of the districts which they opened to trade: the work which they performed laid the foundations of industries which exist to this day.

A. C. O.

ROMAN ROADS IN BRITAIN: I. South of the Foss Way–Bristol Channel. By I. D. MARGARY. *London: Phoenix House*, 1955. 10×7 *inches; 255 pages; maps and illustrations.* 42*s*

A new survey of the Roman roads in Britain was long overdue as much detailed work has been done on the subject in the fifty years since Codrington's 'Roman roads' was published. This survey, sponsored by the Council for British Archaeology, has been undertaken by Mr. I. D. Margary and is to be published in two volumes of which the first covering the roads of south and east England has just appeared. The book is illustrated by photographs and by a series of admirably clear maps, on which any road can easily be identified according to a simple system of numerical references adopted by the author.

The Roman road system strikes the imagination of many people as the most remarkable relic of the Roman occupation of Britain and for them the book provides an excellent summary account of the system, and brings out well our strange lack of knowledge of many of the main elements. No detailed account exists of the Watling Street, the Foss, or of a number of other trunk-roads, written by some one familiar with their whole length, and treating of such matters as date and purpose, choice of route, sighting positions, as well as method of construction so far as that can now be studied in those comparatively rare sectors where Roman work has not been destroyed or obscured in later ages. Many of the most interesting details can only be followed if such an account is accompanied by large-scale maps. It is perhaps too much to expect that a general survey of this kind should include such maps, and yet to get full value from much of the text it is essential to have at hand a map at a scale at least as large as 1-inch to the mile, as the reviewer has found.

Mr. Margary scarcely does justice to the subject of Roman road construction for the matter is not illustrated by a single drawing or section, though many are available for the area of south-east England. A number of the major roads were no doubt military in origin following the lines of advance at the time of the conquest, but the problem can only be profitably pursued when more early forts have been recognized in the area. That there were districts where the roads paid no regard to early military sites is shown by the position of the fort at Hod Hill, in Dorset, which is not integrated with the Roman road system. It may be doubted if the interpretation of the Roman cross-roads at Badbury Rings (pp. 97–8) is correct. Air photographs show most clearly that the Poole harbour road is cut across by the road from Old Sarum to Dorchester and is therefore the earlier. The Poole harbour road probably marks an early line of penetration to the hinterland. At some stage this road junction was replanned with wing roads connecting the arms of the cross.

The engineering of the main road south-west of Salisbury in relation to the heads of the chalk coombs south of the Ebble valley is a splendid example of a route care-

fully chosen in relation to natural obstacles and calls for more detailed description and illustration (p. 96). The mention of Bokerley Dyke, which crosses the road a few miles away, might have been usefully supplemented by reference to the important excavations undertaken there by Pitt-Rivers in 1888–9, when both the road and the Dyke were sectioned and the existence of a native settlement of the Romano-British period established at the junction.

The relation between the main road west of Old Sarum and the "Celtic" field-system on Pertwood Down deserves detailed discussion. This is a critical area for the study of the road in relation to native agriculture, as Dr. Crawford noted long ago. Much could be learnt about the transition from native to Roman wherever a Roman road traverses an area thick with native settlements and the remains of their associated fields. Nor are such instances confined to the chalk downland; for example, at Baston, in south Lincolnshire, King Street is shown by air photographs to override the enclosures of a native settlement, and this is not the only example suggesting that scant regard might be paid to existing villages. There is no mention of the elaborate system of roads in the silt areas of the Fenland though this has been known since the aerial survey of the region undertaken for the Fenland Research Committee nearly twenty-five years ago. The principal fen road runs, for some miles east of March, on a roddon, which follows so direct a line that it cannot mark one of the natural meandering fenland waterways, but must surely be the silted-up course of an artificial channel, perhaps an early feeder to the Car Dyke canal.

The account of the roads at Cirencester (pp. 134–6) is a little unconvincing. The first roads there, if military in origin, would be related to the early fort, wherever that may have been. Later the system may have been adjusted to suit the planning of the town. The whole question of the position of the Foss in the history of the conquest is likely to remain obscure until more military sites have been identified along its course. In later times the road provided a direct route between tribal capitals.

The plates include air photographs and ground views. The air photographs are an effective medium for illustrating the course of Roman roads and sighting positions, and they are well reproduced. The same cannot be said of the ground views, over half of which are unsharp: this is unfortunate for it would be so easy to obtain good photographs of representative sectors of Roman roads, if, indeed, such do not exist already. The inclusion in the text of references to the plates would have helped to link text and plates together. J. K. StJ.

LES CAPITAUX ET LA RÉGION: le commerce et la circulation des capitaux dans la région lyonnaise. By J. Labasse. *Paris: Armand Colin*, 1955. 9½×6 *inches; 532 pages; maps.* 1800 *francs*

Dr. Labasse has acquired a mass of information on banking in the district of France east of the Rhône–Saône and has applied it to the economic geography of the area. As in so much research, the problem of the chicken and the egg emerges: but clearly the banking helps the commerce of the area and the commerce makes the banking. A further factor is that Alpine railways have given remotely placed peasant communities the opportunity of specializing in profitable lines, and buying produce in the markets and fairs of towns and villages. Banking has followed the commerce, and in fact made its expansion possible.

In a study of the commerce, the relationship of town banks to the countryside is carefully mapped and considered: from this it is possible to gauge the economic hinterland of each country market town. These maps are of special interest because they show an intermediate area where towns on either side have an apparently equal attraction, influenced partly by the availability of transport. The larger towns have major offices, and in this part of France Lyons stands out as a regional capital. Its bankers, indeed, have spread their activities far beyond France, conspicuously into North Africa, but naturally the major commerce of the country depends largely on the financial facilities of Paris. This is seen also in retail trade: in France, as in Britain,

major general stores have established themselves in large provincial towns, but in France more by building branches than by buying up local general stores.

Many other aspects of banking are considered in this work. There is a seasonal rhythm of deposit and withdrawal far more marked among agricultural than among industrial communities. The farmer withdraws money in the spring to meet the expense of seed, manures and implements, and acquires his profits after the harvest, or with the sale of his cattle or milk. Given a tourist season, that too is reflected in the banking, especially if there are visitors both in summer and for winter sports. On a smaller scale, the amount taken on normal shopping days in the towns is compared with the takings on weekly market days and the vastly greater sums obtained at the occasional fairs.

To some extent Dr. Labasse has related the location of banks in towns to one another and to the town as a whole. In St. Étienne, for example, all the main offices are in the very centre (Place de l'Hôtel-de-Ville) or as close to it as their proprietors have managed to find premises. In the larger towns this concentration of banks is more pronounced than in smaller towns, of which a number of examples are given: in these the banks are distributed at intervals along the main shopping streets.

There is more in this book than one can indicate in a short review. But one cannot conclude without congratulating its author on the acquisition of such interesting material, not made available to the same extent in Britain nor, it seems, generally in France. In reading this volume, one has the impression that Dr. Labasse has had at times to comment with caution, but nevertheless he can comment. Colleagues in Britain who have studied the economic geography of small towns have known that the bank manager had many of the answers to questions they could not ask him, so they had to try their luck with the vicar and the auctioneer. Dr. Labasse takes us into an entrancing world behind the door labelled "Manager," but only to view more clearly life on both sides of the bank counter. T. W. F.

ORTSUMBENENNUNGEN UND NEUGRÜNDUNGEN IM EUROPÄISCHEN TEIL DER SOWJETUNION. By WOLFGANG MECKELEIN. *Berlin: Osteuropa-Institut an der freien Universität Berlin*, 1955. 10×7 *inches;* 134 *pages; map.* 16.80*D.M.*

One in five place-names in the Soviet Union has been changed since 1918, often more than once, while changes in spelling and grammatical structure increase the proportion to one in two. Now, by listing these names, as well as new towns and settlements, Dr. Meckelein has produced a reference book of much practical value, and it is to be hoped that a further list of names in Soviet Asia will follow.

Basing his list mainly on Russian, Soviet and Germans maps and atlases, Dr. Meckelein gives the names as at 1910, 1938 and 1951, indicating in most cases other names also used between these dates (though not, for instance, Taldom (Leninsk 1921–1929), Petrodvorec (Leninsk in the 1930s) or Nicolaev (Vernoleninsk in the 1920s). Minor changes in spelling, such as Buchach/Budzacz, Beresovitsa/Brzostowica are not included. Each place is classified according to size and type, while an index and map provide the key to the book.

Of particular value is Dr. Meckelein's listing of names in the northern part of former East Prussia—the Kaliningrad oblast'—and in the Lithuanian S.S.R. In the Kaliningrad oblast' the names are all purely Slavonic (thus Schönwalde has become Jaroslavskoe), while in Lithuania the names have merely reverted to Lithuanian (Preil becomes Prejl). Dr. Meckelein does not comment on this linguistic principle, but it may provide an insight into the processes underlying changes of this sort.

A number of Romanian, Hungarian, Czech, Polish and Baltic names are included: these, derived from German maps, are often mis-spelled (e.g. 667 should read Kamieniec-Litewski, 668 Wysokie Litewskie, 751 Ungvár, 752 Volové and Örkömező, 753 Munkács, 755 Beregszász, 758 Maciejów, 760 Sienkiewiczówka, 951 Hânceşti). Some of these are mis-spelled in yet another way in the index. Krasnoarmejsk (865) appears twice on the map, 300 miles apart. D. W.

## TRAVEL IN EUROPE

It is indeed a joy, especially for those who love words well used, to travel mentally to Andalusia (where artists abound and "possess a natural resistance to civilization's more superficial seductions") in the company of a writer as talented as Laurie Lee, author of A ROSE FOR WINTER (*Hogarth Press*, 1955, 12*s* 6*d*). This is a poet's book, where outlines seem clear and colours bright, where human contacts have a memorable quality about them, and we move with a companion sensitive to language, whose gaze never misses the tragic behind the glittering façade. Yet the "thorn-cruel, threadbare" side of Spain, with the "contrabandists" shot and "wheeled like rubbish away," fatherless begging children at Ecija, Seville bullfighting and Granada cave dwellers, is but a backcloth; the highlights pick up figures like Antonio the generous host from a golden age, poetic waiters, the romantic baker of fancy loaves or amorous medical students keen to marry the author's beautiful wife as soon as she is a widow.

A delight to handle, with a wealth of fine photographs printed in France on high-quality paper, is NAPLES AND ITS SURROUNDINGS, by Y. and E.-R. Labande in the *Beaux Pays* series (*Nicolas Kaye*, 1955, 30*s*). This study has no very great literary pretensions but treats most aspects of a lovely city rich in art treasures and historical associations. The visitor to Naples cannot escape the consciousness of successive cultures leaving traces in these naturally beautiful surroundings. Vesuvius and Pompeii are well in the picture, with the Flegreian Fields and Virgil's reputed tomb, to say nothing of those gems the islands of Ischia and Capri. L. R. W.

## ASIA

ABODE OF SNOW. By KENNETH MASON. *London: Hodder and Stoughton*, 1955. 9×5½ *inches; 372 pages; maps, diagrams, illustrations.* 25*s*

This excellent compendium, the work of one who was, for its first twelve years, honorary editor of the *Himalayan Journal*, needs no recommendation to our many members who are closely interested in High Asia. No one could have been better qualified to undertake this long wanted epitome than Professor Mason. For he spent most of his service with the Survey of India and has himself travelled widely in both Kashmir and the Karakoram. And he is, too, a past vice-president of the Royal Geographical Society. He has extracted information not readily obtainable, from the Survey Records and from publications long out of print. The *Himalayan Journal* still lacks a general index and this volume does far more than fill that gap. It is of interest to know that the title, which, of course, interprets the name Himalaya, was actually used over seventy years ago for a book by Andrew Wilson, 1831–81. This was reviewed at length in Vol. 17 of the *Alpine Journal*, apparently by Douglas Freshfield, who was editor at that time. In that review he describes Wilson as "The Pioneer of climbing in High Asia."

The body of Professor Mason's book is divided chronologically into six parts: The mountains and their approaches; Early history to 1885 (which includes the fascinating stories of the "Pundit" surveyors); four succeeding periods are followed by an "Epilogue: 1954 and the Future." Each period is sub-divided geographically; and not only is the text most readable but the volume is light enough to handle comfortably, thus differing from some other Himalayan tomes.

No work of this standard can remain exempt from criticism. An age-old controversy is revived in the questioning of W. W. Graham's "ascent" (the quotes are Professor Mason's) of Kabru in 1883, and of the identity of Graham's Kabru with the Kabru so gallantly assaulted by Rubenson and Aas in 1907, and scaled by C. R. Cooke in November 1935. And this despite the fact that, prior to Cooke's success, two of our greatest mountaineers had upheld Graham. About the time of his claim doubt was also cast on his ability to climb "fantastically fast at such a

height," but it should be remembered that Longstaff's ascent of Trisul, with the Brocherels, was equally speedy. Of course maps were far from trustworthy in those days, and an ice-fall can change a lot in fifty years. Yet Graham may have made a mistake and as the Professor writes, "in the Himalaya he would be neither the first nor the last to do so."

Professor Mason has rendered tribute to the founder members of the Mountain Club of India of which the first President was Charles Bruce. He commends the spirit of cooperation and good will through which merging with the Himalayan Club eventually came about (in 1929). However, parents of the Mountain Club have pointed out that the implication of approximate twinship is misleading. For the birth, on 23 September 1927, of the Mountain Club was the result of a talk on the Alukthang Glacier in 1925, whereas the conception of the Himalayan Club took place on "the path behind Jakko" in October 1927 and it came into actual being in February 1928. It is a pity that the die-hards of Bengal were not in closer touch with those of like spirit in Simla. The true foundation dates of some other climbing clubs have occasionally been in doubt but it is felt that in a standard work of reference such as that given us by Mason the correct sequence of important events should be maintained.

Although mention has been made of Hunzas in several places it would have been relevant and helpful had an observation been made that these fine cragsmen constitute the potential equivalent in the Karakoram of the Himalayan Sherpas. Also that, although it has not yet been ruled out officially, employment of the latter in Pakistan would not, to put it mildly, be popular.

Only one slip has been noticed. Gosainthan has been described as a place of pilgrimage for Hindus—"like Muktinath and Pashpati." Surely the sacred lake of Gosainkund is intended; for Gosainthan is within forbidden Tibet, towering up to 26,291 feet. The sketch-maps are, as would only be expected, first class and a remarkably fine selection of photographs has been made. Perhaps the most impressive of these is that of "The Monsoon about to burst," taken from Mussoorie.

H. W. T. and W. A.

THE ECONOMIC DEVELOPMENT OF SYRIA. Report of a mission organized by the International Bank for Reconstruction and Development at the request of the Government of Syria. *Baltimore: Johns Hopkins Press*, 1955. 9×6 *inches;* xviii+486 *pages; maps.* 60*s*

This is the report of a mission to Syria, organized by the International Bank for Reconstruction and Development, which visited the country in 1954 at the request of the Syrian government. The task of the mission was to review Syria's economic potentialities and to formulate a development programme for increasing the country's production and raising the standard of living of its people. The bulky report contains a thorough study of the Syrian economy as well as the numerous recommendations made by the mission. As an excellent compendium of relatively up to date and reliable facts and figures the book will be of value to all interested in Middle Eastern affairs. The chapters and annexes on agriculture, animal husbandry, land policies and land settlement, irrigation, industry, transport and communications will be of particular interest to the geographer. Some of the important topics which are especially well dealt with are the growth of the Syrian economy in the last two decades, the potentialities of Syria's rivers for power and irrigation, and the development of the Jezireh, Syria's "prairie province."

A discussion of the merits of the mission's recommendations is beyond the scope of this review. One hopes that the "dirigeants" of Damascus will make good use of the report and that the International Bank will make a loan to assist in the implementation of some of its many recommendations. One may reasonably have doubts on these scores, and may wonder if some of the mission's less fundamental suggestions might have been omitted, but it is certainly true that Syria will benefit greatly if any of the major recommendations are adopted. There are a few minor and unimportant

errors. There is one puzzling feature: almost nothing is said of the very important petroleum pipelines which cross Syria, and they are not even shown on the maps.

N. N. L.

MAN OF EVEREST: The autobiography of Tenzing, told to JAMES RAMSAY ULLMAN. *London: Harrap*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 320 pages; sketch-maps and illustrations.* 18*s*

As several previous reviews have pointed out, Tenzing is illiterate and, moreover, his mother tongue is not a written language. To produce an "autobiography" under these circumstances is, to say the least of it, ambitious for the story must of necessity be recorded through the medium of interpreters and is inevitably open to the criticism that the sentiments expressed are not exclusively those of the principal.

However this may be, Mr. Ullman has produced a thoroughly readable and most interesting book. It is written, for the most part, in a simple and straightforward style that is entirely appropriate.

Tenzing is fortunate indeed that his life has been cast in pleasant places and that it should have been crowned by the achievement of his greatest ambition. There is no doubt that he has told his story both frankly and well. That there should be some omissions and inaccuracies is inevitable. For instance it is strange that no mention should have been made, in Chapter 11, of Peter Lloyd who was Tilman's climbing companion in Nepal in 1949.

It is a pity that an element of malice should have been allowed to creep in to the latter part of the book and, although Tenzing's reactions to the national characteristics of the various mountaineers with whom he worked are interesting, I feel that the matter has been unduly stressed. Those of us who had the pleasure of meeting him when he visited this country after his great achievement were impressed by his inherent good nature and his honesty and sincerity. It is therefore the more regrettable that certain incidents should have been recorded in this excellent book, without explanation, the reasons for which are obvious to anyone in a position to appreciate the full circumstances. The book is well illustrated by many beautiful photographs for which acknowledgement is duly given.

D. L.

HIMALAYAN BARBARY. By CHRISTOPHER VON FÜRER-HAIMENDORF. *London: John Murray*, 1955. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xiv + 241 *pages; map and illustrations.* 21*s*

Of the few inhabited regions of the world left to be explored the sub-Himalayan belt on the northern frontier of Assam is probably one of the most important. In the part so admirably described by Professor Haimendorf there live the peace-loving Apa Tanis in their upland valley, so intensely cultivated that it supports a population of a thousand to the square mile, surrounded by restless, raiding Daflas sparsely scattered in small villages and living by shifting cultivation. The author, from the fringe of the hardly known, made a reconnaissance into the unknown. He could have had an armed escort had he wanted one, but he and his wife, deciding that arms would provoke armed opposition, preferred to go unescorted, feeling their way, as it were, from village to village. This bold plan proved entirely successful and it was only shortage of trade goods wherewith to pay porters that compelled them to turn back. Had not the demands of the Second World War made an air drop of supplies impossible they might well have reached the main Himalayan range and ascertained the extent of Tibetan infiltration, which was exercising the mind of the Government of India at the time. It is difficult in a brief review to do justice to this important book. Not only does it contain the fullest account ever published of the customs and habitat of the tribes, but it is a challenge to explorers and geographers to discover and describe more of the Assam frontier areas. For instance, broadly speaking, while the Nagas of the southern frontier are grouped on ranges, the tribes of the northern frontier are grouped on valley slopes between ranges which divide them. This contrast and the densely populated Apa Tani valley are only two among many promising fields for the study of human geography.

The illustrations are excellent, but the sketch-map and index could have been more adequate. A surveyor was attached to the party. One wonders if official maps embodying his work have ever been published. J. P. M.

SOCIAL FORCES IN THE MIDDLE EAST. Edited by SYDNEY N. FISHER. *Ithaca, N.Y.: Cornell University Press*, 1955. 9×6 *inches;* xv+282 *pages; maps.* 40*s*

It is always a hazardous venture to make a book from reprints of lectures or speeches at a conference. This is no exception; the papers were first read at a conference on the social dynamics and cultural setting of the Near East, but with a view to subsequent publication they were revised in the light of discussions and brought up to date. The conference took place at Princeton towards the end of October 1952 and this book was published about three years later. Whether it is due to the reprinting of basically unsuitable material or to some other cause, this is a book of uneven quality which does not succeed in making clear many points of general application to the many countries discussed. This is not altogether surprising, but it may confuse the unwary reader.

The book takes the form of a series of chapters about Middle Eastern types—the nomad, the farmer, the economic planner—described in relation to their surroundings. The editor has clearly been at pains to make some order out of what must once have seemed sadly chaotic; there are however a few excellent chapters, notably that on the role of the Army officer in politics. A constant attempt is made, throughout the book, to include Israel in the ground surveyed but it only succeeds in underlining Arab-Israeli differences time and time again; reconciliation in print is a difficulty that need hardly have been tackled in a book of this sort, one feels. But even these chapters, such as that on "The immigrant in Israel," sometimes give a survey that is valuable, if doubtfully relevant to the main social forces of the Middle East as such.

R. A. R.

A MOUNTAIN CALLED NUN KUN. By BERNARD PIERRE. *London: Hodder and Stoughton*, 1955. 8½×5½ *inches;* 89 *pages; maps, pictures and sketches.* 16*s*

It was a happy coincidence that in 1953 both John Hunt and his friend Bernard Pierre should be leading successful expeditions at opposite ends of the Himalaya. But it seems strange that Nun, the second highest peak in Kashmir, only 60 miles from Srinagar, should have remained inviolate for so many years. And it is interesting that only one of the team had had previous Himalayan experience. And also that of the two who reached the summit one, Mme Claude Kogan, became thereby the woman's altitude record holder. The other was the Swiss Protestant Pastor from Leh, who left his flock with the message, "The Pastor has gone to the presence of the Most High." Bernard Pierre's vivid narration of the course of events, his intimate portrayal of those taking part and his picturing of the wonderful setting are all brilliant. The avalanche, which brought two of his party to the brink of death, the wiping out of Camp III, his esteem of their Sherpas and his own unhappy renunciation from the final assault are all told of with typically Gallic freedom from inhibition. To quote Sir John Hunt, "an intensely human story." The translation, by Nea Morin and Janet Adam Smith, leaves nothing to be desired. H. W. T.

ROAD TO RAKAPOSHI. By GEORGE BAND. *London: Hodder and Stoughton*, 1955. 4½×6½ *inches;* 192 *pages; illustrations, maps and diagrams.* 16*s*

This account of the doings of six members of the Cambridge University Mountaineering Club makes excellent reading. The road to their objective in the Western Karakoram took them right across Europe and half across Asia. Ted Wrangham has contributed a pleasant description of the journey and tells of many happy encounters and of the almost unfailing help rendered by British and other officials. Rakaposhi—the "Dragon's Tail"—some 25,560 feet in height, had been tackled without success by two previous smaller parties. The Cambridge team was stronger and better

equipped, though far from the lavish scale of the big Italian expedition to K2 a few weeks earlier.

George Band takes up the story from the arrival in Rawal Pindi, a few days before schedule. Just before leaving England they had been staggered by the news that an Austro-German party had been given permission to attempt, not only Rakaposhi but also Dastoghil, 25,780 feet, in the Hispar Mustagh. Fortunately these potential rivals decided, after reconnoitring, to try further north. Another stroke of luck came to them in the person of General Hayaud Din—"Gunga" to his host of friends. He was then Chief of the Pakistan General Staff and decided to accompany the Cambridge expedition as liaison officer. Their attempts followed much the same lines as had been taken by their predecessors: first the north-west ridge and then the south-west spur. Their setbacks were likewise very similar, and though they did in fact open a way to the summit by their "first ascent" of the "Monks Head," they were in no fit state to exploit this success. Contenting themselves with this achievement they made their way down to Base Camp, the first stage of their long journey home. The maps and diagrams are excellent, but the photographs, though interesting, are hardly up to standard. H. W. T.

## AFRICA

NATURAL RESOURCES DEVELOPMENT COUNCIL: POPULATION DISTRIBUTION OF THE UNION OF SOUTH AFRICA, 1951. (A map in two sheets); with an explanation by Dr. J. H. MOOLMAN, Director of Planning. *Pretoria, 1954: The Government Printer, T.S.O. MISC. 1097. Sheets 3s 6d each. Explanation 2s*

The mapping of population distribution is always a complex and controversial process. The presence of four racial groups, which for social and political reasons must be separately identified, adds to these complexities. In this new map, therefore, dots and spheres are pictorial symbols not only of the total number of human beings, but also of the proportions of Europeans, Natives, Coloureds and Asiatics in the Union of South Africa. Under the direction of the Planning Staff of the Natural Resources Development Council, qualified field workers plotted the distribution of these groups on topo-cadastral maps having a scale of 1/250,000. From these and the 1951 Census a map on the scale of the New National Series of 1/1,500,000 has been published. What is virtually the rural population is represented by dots and the urban by conventionalized spheres. Contrasting colours are used to differentiate the races. On the light green background these are clear and distinct, although the ochre-yellow for Coloureds tends to lose itself in the chocolate-brown where Natives predominate.

In a short explanatory pamphlet, Dr. J. H. Moolman, the Director of Planning, discusses the distribution of the total population and of its component parts, the rapid changes resulting from urbanization, and finally, in simple terms, the geographical factors which influence population distribution in the Union. A small map in the text shows that most of the Union's Native Scheduled Areas are to be found east of the 20-inch isohyet, which is considered by many to be the most significant ecological boundary in the country.

Because this population map is backed by careful field work and reliable census statistics, it should become an important tool of geographical interpretation. It is unfortunate, therefore, that for reasons of economy its usefulness should have been reduced by final publication on a small scale. It should be noted, however, that "sunprint" copies of the large-scale field sheets in which one dot equals ten persons are obtainable from the offices of the Natural Resources Development Council, Pretoria. It would have been interesting, too, to have had in the pamphlet some indications of the way in which field workers set about the task of plotting population distribution, especially in the densely populated Native Areas. The fine technical qualities of the map are a tribute to the South African Trigonometrical Survey and the Government Printer, who have accomplished the difficult overlaying of colours with

only one minor and perhaps intentional discrepancy: all print, boundaries, railways and rivers are coloured brown in the Key, yet appear as dark grey on the map.

In the Union, where regional planning is now recognized as an essential preliminary to economic development, the fundamental research which went to the preparation of this publication should prove invaluable. It should also act as a pointer and stimulus to less advanced African territories, for without full appreciation of this demographic pattern, regional development is a waste of time and money. D. L. N.

EQUATOR FARM. By RODERICK CAMERON. *London: Heinemann*, 1955. 8½×5½ *inches;* 158 *pages; map and plates.* 18*s*

'Equator farm,' as the author says in his foreword, is a record of personal experience. In a leisurely fashion Mr. Cameron journeys from the farm in the White Highlands of Kenya which gives the book its name, to Nairobi and then on to Mombasa. He visits the ruined city of Gedi, the forgotten port of Lamu, and the island of Zanzibar, returning to his farm by way of Kilimanjaro and the Masai reserve. At this point one feels the book should have ended, but a final chapter dealing with a short visit to the Kabaka of Buganda is tacked on. In this chapter weight is added to the rather flimsy material of Mr. Cameron's own experience by long quotations from the journals of Speke and Stanley. In addition, the reader is jarred by several inaccuracies, including the use of "Bugandans" for "Baganda," while Uganda is confused with Buganda in the statement "Uganda is split up into twenty *sazas* or small polities."

The merit of 'Equator Farm' lies in the really excellent descriptions. Mr. Cameron has succeeded in conveying the quality of his enjoyment as he wished to do. But the book is rather formless, and the many quotations and well-known anecdotes from other works on East Africa (all scrupulously documented) make it of interest mainly to those with no previous knowledge of the region. 'Equator farm' is beautifully produced. The photographs and engravings are good, and the print is a pleasure to the eye. The descriptive writing, and the sensitivity of the author, raise it above many travel books. Yet one cannot help wondering who will find it worth while to pay eighteen shillings for a book which once read is not likely to be referred to again. J. R.

ZAMBESI RIVER. By J. F. MACDONALD. *London: Macmillan*, 1955. 8½×5½ *inches;* 236 *pages; maps and photographs.* 18*s*

This is a delightful book—the story of a great river and its people by one who has travelled down it and is a geographer at heart,. Beginning with a vivid pen picture of Livingstone wearily journeying over its headwaters just a century ago the author takes us steadily down to its mouth. Through apt phrase and dry humour we share with him the experiences of many a riverside camp, their charm and their petty annoyances. But the real matter of the book is the people—from the Africans who, lagging two thousand years behind our times, are being hustled along to catch up, to the white men who, willy-nilly, are leading their child minds "into the complexities and challenges of this restless age."

In a valuable digression we are taken up on to the plateau of Southern Rhodesia for a balanced assessment of its human and physical atmosphere; in fact, a sanity of judgment on social and political problems is the outstanding feature of the book. It deplores yet understands the attitude of Afrikaner-dom, it smiles at the perfervid patriotism of Rhodesians yet admires it. It breathes a spirit of hope in the future of that grand experiment in race-partnership, the Federation of the Rhodesias and Nyasaland, and describes it well as the middle and sound way between the Apartheid of South Africa and the opposite extreme of the Gold Coast.

Returning to the Zambesi we run the rapids of the Kariba Gorge whence soon there will arise another great experiment, a man-made lake 200 miles long. Though we miss the Kebrabasa Gorge, the scene of defeat for Livingstone's noblest plan, we traverse the fertile if fevered plains of the delta and read its history. In spite of a somewhat sketchy map and some confusion over Chief Sebituane this is the most accurate, readable and balanced book on the region yet produced. F. D.

L'ADRAR MAURITANIEN (SAHARA OCCIDENTAL): Esquisse géologique. By TH. MONOD. Bulletin de la Direction des Mines No. 15. Gouvernement Général de l'Afrique Occidentale Française. *Dakar: Grande Imprimerie Africaine*, 1952. 10½×8½ *inches;* 2 vols.: Vol. I, 284 *pages and* 3 *maps in pocket at end;* Vol. II, 285–458 *pages. Appendices*

Those interested in the geology of Africa are becoming accustomed to the outstanding publications of the French territories in Africa. The present volumes are exceptional even by those standards and a belated tribute is due to the author for the impressive results of his journeys and geological surveys in the Mauritanian Adrar. The first volume deals with the geology, structure, and morphology of the vast area which he surveyed, the second consists of appendices by specialists. Both are lavishly illustrated: a coloured geological map on the scale of 1/500,000, a 1/80,000 topographical map of the spectacular denuded "dome" of Er Richat, and an air photograph mosaic of it at the same scale are included.

A detailed review is not intended here. It will suffice to say that the personal accomplishment of the author in so wide and inhospitable a region is formidable, though it receives little attention in the text. The demonstration of some features of exceptional geological interest is the main theme—for example, the successive scarps (*tassili*) giving remarkable geological continuity, craters and other large-scale circular structures (such as Er Richat), and the presence of silica glass which is probably of meteoric origin. The morphological development of the varied terrain is a matter of special importance to geographers and physical geologists. Despite their regional setting, the volumes are of more than Saharan, or African, interest; there is material of general value to several allied sciences. The Bulletins have a limited circulation, but these two volumes should be brought to the general notice of readers of the *Journal*.

K. S. S.

LA TUNISIE ORIENTALE: Sahel et Basse Steppe. By JEAN DESPOIS. (Second edition), *Paris: Presses Universitaires de France* 1955. 9×11 *inches;* 554 *pages; maps and photographs.* 2800 *francs*

This authoritative work by a well-known geographer first appeared in restricted circulation in 1940. It has now been revised, with recent statistics, some new data, especially on geology and hydrology, and with a useful index. Professor Despois seeks to answer four questions in his book, which he does not regard simply as a regional monograph. To what extent have the landscapes and their modes of life depended upon human rather than physical factors? Does the poverty of natural resources permit an important extension of crops and sedentary life in the steppe? If the land is capable of development can the traditional outlook of the nomad also be changed? Finally, what assessments can be given of the achievements made by the Protectorate administration during the last fifty years? Clearly, the answers involve issues fundamental to most North African problems, making the book of much more significance than a mere detailed geographical study of three Tunisian regions: the Sahel, the Sfax hinterland and the Steppe.

The physical and historical backgrounds, outlined in the first two parts, answer the first question. The Sahel in particular has little individuality; *sensu stricto* it is a human region. Its changes are impressively dealt with in the history of the past two and a half millenia, with special attention to four great episodes in its sedentary occupation. This history affords lessons for the modern settler, more fortunate in this respect than the pioneer of the New World who has had to learn from his own sad experience. Tunisian history has proved the folly of pushing cereal cultivation too far into the Steppe, and shown that arboriculture, especially of olives, is a better choice for the southern lands. The present types of rural economy, the modes of life and settlement are dealt with in parts three and four. The second question is also confirmed by the appraisal of present resources. Dry-farming remains the chief prospect. Apart from government schemes to settle nomads, economic trends are likely

to solve this problem more naturally. The achievements of the French occupation are, of course, fully realized.

The book is especially valuable as a study of the modes of life in eastern Tunisia. It can also be commended, however, for its conclusions on more general Mediterranean problems. Professor Despois finds no evidence to support the theory of climatic change in historical times; he disproves the legend that irrigation was formerly more extensive; he believes that the sedentary cultivator of the Sahel has done more to alter the natural vegetation of the Steppe than the nomads, and that more havoc has been caused by cultivating and then abandoning land than directly by the nomads. The broad outlook of the book whets the reader's appetite. What are the pedological features of the erosion surfaces? Where are the climatic limits of the desert and the arid realm? What was the extent of the two types of Roman centuriation? If such academic questions must await further research, Professor Despois has done much to answer others which are more pragmatic and urgent.

J. M. H.

THE NATURAL HISTORY OF TSETSE FLIES. By P. A. BUXTON. School of Hygiene and Tropical Medicine Memoirs No. 10. *London: H. K. Lewis*, 1955. 9½×7 *inches;* xviii+816 *pages; map, illustrations, diagrams.* 84*s*

This is a work of geographical significance, broad in approach yet assembling much detailed work in such a way as to avoid unjustified generalization. It does a great service to geographers and doubtless to administrators and others interested in Africa, as well as to zoologists, veterinarians and doctors more closely concerned with the problems of tsetse flies and trypanasomiasis. After a broad and stimulating introduction which puts these problems in perspective, the main body of the work is a systematic discussion concerning the flies, their ecology, their relations with disease in man and cattle, and the various methods of control suited to different flies and different environments. This is a long book, but its length should not be permitted to repel. It is well written and well illustrated—the collection of photographs at the back is in itself worthy of study—and so well indexed that reference is easy. Tsetse flies are treated as a whole, but it is easy to follow say the clinatic or vegetational associations of a waterside tsetse like *Glossina palpalis* or a tsetse of *miombo* woodland like *G. morsitans*. The importance of occasional climatic accidents is stressed—a few hours of very hot and dry weather, a flood, a frost perhaps occurring at intervals of some years; and again of microclimates of scrub and woodland. Quite small patches of soil of texture and organic content suitable for the larva to bury and prosper may be vital to the fly, and zones at the junction of vegetation types important in the feeding of adult flies. Extensions of the tsetse area—apparently not due to pressure of population—and possible contractions are examined and possible causes considered. Control measures may lead to rural development schemes as in the Anchau corridor in Northern Nigeria, going far beyond mere insect control or disease control. Soil exhaustion or erosion may develop if a population density is maintained sufficient to keep the tsetse at bay, but in one area in Tanganyika no harm has been apparent after twenty-five years. A final synthesis on tsetse flies in relation to disease is brief and masterly, but will be most appreciated by those who have been able to read all or most of the preceding chapters.

The drawings (of anatomical details of the flies, etc.), and the maps and diagrams, by H. S. Leeson, have been rightly praised for their massive assembly of material from many sources. They are clear, but sometimes to geographical eyes a little old-fashioned in cartographical technique.

A. T. A. L.

LIVINGSTONE AND AFRICA. Teach Yourself History Series. By JACK SIMMONS. *London: English Universities Press*, 1955. 3½×7 *inches;* ix+180 *pages; maps and frontispiece.* 7*s* 6*d*

The Teach Yourself History Series, edited by A. L. Rowse, aims to introduce history

by means of biography, and between thirty and forty volumes have so far been published. In the words of Mr. Rowse's general introduction, all are designed "by way of a biography of a great man, to open up a significant historical theme." When the historical theme of the nineteenth century discovery of Africa came to be treated in biographical form, Livingstone was of course the obvious great man to represent the scene, and Professor Jack Simmons' excellent short study of him will be useful beyond the limits of the series for which it is written. It is not easy to put the famous missionary–explorer into a nutshell: Livingstone marching through Africa with his Makololo and Livingstone on the Zambesi might sometimes be two different people. But Professor Simmons is so wise in his assessment of Livingstone's essential qualities, so sure that the bright side was the right side of his character, that admirers and critics of the Doctor will alike feel their ideas have been clarified when they have finished this little book. D. M.

## SOUTH AMERICA

THE UNTRODDEN ANDES. By C. G. EGELER and T. DE BOOY. Translated from the Dutch by W. E. James. *London: Faber and Faber*, 1955. $8\frac{1}{2} \times 6$ *inches; 203 pages; maps and photographs.* 25*s*

The original Dutch title of this book, "Naar onbestegenen Andes-Toppen," is more precise than its English rendering, which is perhaps somewhat over-dramatic when applied to the Cordillera Blanca of Peru, a range visited and mapped by many expeditions, both climbing and scientific, since the extensive pioneer work of the Germans and Austrians in 1932. But in the mountaineering sense this small Franco-Dutch party (the two authors and Lionel Terray) broke much new ground by making the first ascent of Nevado Huantsan, in 1952 the highest unclimbed "six-thousander" in Peru, and two other virgin peaks in the same district, Nevado Pongos (18,737 feet) and an unnamed mountain which was christened Nevado Queshque (17,923 feet). This latter was climbed by the two Dutchmen prior to Terray's arrival. Huantsan (20,981 feet) was climbed at the third attempt by the long north-west ridge. Earlier, de Booy had had a remarkable escape in a 300-foot fall, which occurred while the party were roping down in the darkness from the north ridge after an unsuccessful attack by this route. Fortunately, as it turned out, this delayed their schedule enough to enable them to weather at a lower altitude, a violent three-day storm which would have been disastrous if it had caught them in Camps III or IV, high on the narrow ice ridges of this extremely difficult mountain. The quality of Terray's leadership, and the admirable stamina and determination of the two Dutchmen, is well brought out by their account of this successful international expedition. Besides climbing the three peaks, Egeler and de Booy, both of whom are Amsterdam geologists, did a fair amount of geological survey work in the valleys of the southern Cordillera Blanca, and the results of this are incorporated in a final chapter of the book, which is well illustrated by 32 photographs and nine line diagrams and maps. T. C.

## POLAR

The work of the Falkland Islands Dependencies Survey has now continued for over ten years; it seems an odd thing therefore that Kevin Walton's TWO YEARS IN THE ANTARCTIC (*Lutterworth*, 1955, 15*s*) should be the first popular account to be published by any member of the Survey. Mr. Kevin Walton enjoys a well deserved reputation as a traveller and now his book shows that he is also a writer of great ability; it is certainly one of the most readable books that have come out of the Polar Regions. The two years in the Antarctic are those of 1945–8, a period when the Survey was emerging from its war-time hush hush, perhaps the most interesting period of the Survey's history. Not only were the leaders, first Surgeon Commander Bingham (to whom the

author pays a most fitting tribute) and later Major Butler, faced with all the problems and anxieties inherent in polar exploration, but first visits of Chilean and Argentine warships and then the arrival of an expedition from the U.S.A. under Commander Finn Ronne called for a skill in diplomacy of a high order to avoid international complications. The successful cooperation between the British and American expeditions, achieved after the initial estrangement, redounds to the credit of both parties; or was it (as Mr. Kevin Walton writes) "that time and the friendliness of Antarctica soon sorted it all out?"

The book is well illustrated with photographs but there are only two maps, which are not really adequate for following the narrative and surely such an otherwise excellent book deserves a more original and better selling title.

WINTER, by Cornelius Osgood, is the story of an ethnographer's experiences during a winter spent on the shores of Great Bear Lake in 1928–9 (*Robert Hale*, 1955, 18*s*). It tells how the writer, who was then a young man, learned to stay alive in a world completely foreign to him but commonplace to the trappers and Indians amongst whom he lived. The popularity of Mrs. Dale's Diary naturally leads us to suppose that there is a firm market for this kind of writing, and this book is good writing of this kind. The study of the characters of the dogs, the kindness of the trappers to the novice and the frequent references to sex and the normal natural functions contribute to the build up of this "strange and haunting story of a lone man's experience in the far north." Q. R.

## PHYSICAL AND HUMAN GEOGRAPHY

STRUCTURE, SURFACE AND DRAINAGE IN SOUTH-EAST ENGLAND. By S. W. WOOLDRIDGE and D. L. LINTON. *London: George Philip*, 1955. 10×7 *inches;* viii+176 *pages; maps and diagrams.* 17*s* 6*d*

When the Institute of British Geographers, in pursuance of their then policy of providing a vehicle for studies of monograph length, published this essay in 1939, it was at once hailed as an important contribution to regional geomorphology. It did more than provide a convincing explanation of the subject matter implicit in its title, it demonstrated also important principles by which minute attention to the form of the land and the pattern of the drainage could fill many of the obstinately surviving blanks in the integration of the geological history of this intensively studied region. That it was much read both for its subject matter and its methods is clear from the fact that it quickly went out of print and the revised reissue is the response to a continuing demand.

In the years between, the authors have gathered fresh information which has enabled them to amplify their account of the drainage of the Weald, to deal more fully with the later stages of the Pleistocene development of the London Basin and to add four new and informative text-figures; but although much more fieldwork has now been done, some of it by their own pupils, and much still remains to be done, the author's see no reason to change their earlier conclusions in any essential respect.

The bibliographical references, swollen a little since the first edition, have been taken out of the text and are listed at the end in the order in which they arise. An index (8 pages) is now provided and the search for localities on the map, whose space relations are essential for following the argument, is facilitated by the provision of an index of some eight hundred place names with their National Grid References. These improvements have considerably lightened the task of mastering a work whose wealth of detail and close reasoning still make heavy demands on the reader's concentration and memory. For the authors are merciless in their insistence on the importance of detail and in their condemnation of the laconic and superficial treatment accorded to the physical background in much current regional geography. Instancing, for example, "the myth concerning the open and down-like character of our chalk upland country," they have presented the regional geographer with the hard and infinitely

complicated truth as an alternative to the facile generalizations of the past. The authors modestly offer the fruits of their own arduous and disciplined field study as their contribution to the full and proper understanding of the total geography of the region, on which they emphatically insist as the final objective of the geographer. Without a doubt regional geography can, if it will, benefit immeasurably from this generous gift, but many, especially in the Continental and American schools, will protest that geomorphology is a science in its own right, that its findings are valuable for themselves alone and that it stands in no need of excuse or justification as the modest hand-maiden of regional geography. A. A. M.

DAS RELIEF DER ERDE. By F. MACHATSCHEK. *Berlin: Borntraeger*, 1955. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; maps and diagrams. Vol. I*, xi+531 *pages; DM.* 74. *Vol. II*, vii+594 *pages*

These two volumes together include more than 1000 full and well-printed pages; as the title suggests, they deal with the relief of the Earth, and its evolution. The work is primarily a great compilation based on the author's wide reading; since, however, he has also published much original work he is able to draw on his own field knowledge where it is relevant, and, having himself worked in many areas, he is well able to assess the written work of others. Anyone wishing to find information about the general build and structure of any major part of the Earth's surface can do so by consulting these volumes. The treatment varies with the amount of material available. There are, for example, thirteen full pages of bibliography referring to France and Central Europe, and about the same number for Canada and the U.S.A. These lists of books and articles are valuable and, as a rule, comprehensive, but in looking through them one notes a fair number of minor errors in spelling and initials. Anyone familiar with a given region will almost certainly find grounds for some kind of criticism of its presentation in the text, but perhaps this is unavoidable, since no book can be wholly comprehensive. The references given to the British Isles are generally well chosen, but will hardly give complete satisfaction to a British reader. Furthermore, a glance through the pages dealing with these islands shows that each main area is discussed and its traits described—but one would often like rather more detail. The same is doubtless true of other places. Yet the general overall balance is remarkably sound. Apart from analyses of the continental masses, reasonable space is also given to a discussion of the ocean-bottom features. This is not only a good point in itself, but also serves to emphasize the "one-ness" of the Earth's surface. The fact that so much is covered by water should not prevent us from doing our best to study it as part of the relief of the Earth.

These volumes are useful not only for their lucid accounts of the hundreds of regions described, but also for showing their interrelations with neighbouring ones. The concluding chapter contains a good account of the main tectonic features of the Earth's surface. The maps and diagrams are clear and to the point, but there is little use of block diagrams. This is a pity since if they are carefully drawn they can show at a glance a great deal about the evolution of the area under discussion.

The first edition of this work was destroyed in an air raid, and the present one represents some ten years' work. It may not unfairly be described as a typical German compendium. To say this in no way underrates its value to geographers and others who want to study the features of the Earth's surface, or the "composition" of a region before tackling it in full detail. With the vast increase in the publication of original work, one feels that there is less and less likelihood of any author being able to follow Machatschek's lead. We may congratulate him on the fulfilment of a long and arduous task in which he has done good service to his colleagues in all countries. As a source and reference book, the volumes should be easily available for students of the Earth Sciences, and so should find a place in many libraries. Their appearance is pleasant, and they are written in a style which should not present too many difficulties to those who, like the reviewer, struggle with, rather than read, German. J. A. S.

INTRODUCTION TO PHYSICAL GEOLOGY. By CHESTER R. LONGWELL and RICHARD FOSTER FLINT. *New York: John Wiley; London: Chapman and Hall*, 1955. 9×6 *inches;* x+432 *pages; maps, illustrations, diagrams.* 40*s*

The authors state as their aim the production of "a streamlined textbook, reasonably complete for an introductory course but concise, clear and economical." They have succeeded admirably, and have indeed done far more. This book is at once informative, refreshing and stimulating. Its four hundred pages contain a great deal of material—no less could be expected from two authors of so high a standing—but nowhere does the text founder in a sea of detail. Facts are presented strikingly but not over-dramatically; selective inclusion and omission are alike commendable.

Three short introductory chapters are followed by discussions of the geological time-scale and of igneous rocks; next come weathering, mass-wasting and subaerial sculpture of the land, then submarine geology, shoreline evolution, and sedimentation. The book concludes with chapters on crustal deformation, metamorphism, the earth's interior, mountains and geosynclines and industrial geology. Useful appendices relate to the identification of common minerals and rocks, to geological maps, to symbols and to conversion-tables. This unaccustomed ordering of topics serves at least as well as a more usual sequence; in any event, as the authors discovered by enquiry, there are wide variations in the order followed in teaching.

Treatment of controversial topics and the use of illustrations are most impressive. Where some important hypothesis is merely an intelligent guess, or where essential information is still undiscovered, the circumstance is plainly stated. In discussing meandering streams, for instance, the authors say "we have not explained precisely *why* meanders develop, for the simple reason that we do not know. This is a problem still to be solved." Illustration is brilliant. This is one of the very few books where illustrations are inseparably related to the text. Every one counts. Diagrams and photographs alike are fully annotated; in particular, careful attention has been paid to the linear scale in illustrations, as in the text to the scale of geological time.

It is certain that the illustrations will be of great help to the readers for whom this book has been written, for many serve as simple guides to complex ideas. In this connection it should be noted that the whole content of the text is up to date, taking good account of recent advances, e.g. in petrology, hydrology and tectonics. The work must commend itself to a wide public. G. H. D.

LAND, WATER AND FOOD. By HERBERT ADDISON. *London: Chapman and Hall*, 1955. $8\frac{1}{2}\times5\frac{1}{2}$ *inches;* 248 *pages; illustrations.* 18*s*

This is a topical commentary on the management of water for irrigation and land reclamation, written by a former professor of hydraulic engineering and intended for the general reader. A preliminary account of the relationships between rainfall, evaporation and run-off is illustrated by a number of useful diagrams. Some important desert areas in Asia are omitted from a map of Arid Zones of the world (page 3). The main part of the book consists of short studies of several water control schemes; first, reclamation in the English fenlands and Holland, and then irrigation in Egypt, Asia Minor, Australia, India and the U.S.A. In each of them the parts played by natural conditions, engineering skill, economic need and personal initiative are clearly distinguished. The scale of the works is always evident so that one can readily appreciate the relatively small size of those in the Jordan valley and Australia, for example, as compared with those in the Nile valley and India. In all, it is estimated that irrigated or artificially drained land provides somewhat less than one-tenth of the world's food, and in a final chapter the author attempts to estimate how much new large-scale engineering works can contribute to the world's food supplies in the next fifty years. Incidentally, it may be noted that he rates the potentialities of the Sahara for irrigation as rather low (page 124). One very important problem that receives a good deal of emphasis is the increasing costs of water control schemes. Half a century ago they could be reckoned in terms of a few pounds per acre reclaimed or irrigated; now tens

or hundreds of pounds per acre are needed because all the best sites have already been developed. This book can do much to make irrigation for the geography student something more than a talisman, and to provide a good deal of pleasure to those who like juggling with inches of rainfall, square miles of catchments and milliards of cubic metres of discharge A. T. G.

SUN, SEA AND SKY: Weather in the making and in our lives. By IRVING P. KRICK and ROSCOE FLEMING. *London: Victor Gollancz*, 1955. 9×5½ *inches; 248 pages; charts and illustrations.* 16*s*

The sub-title gives the clue to the scope of this volume whose main title might suggest an aesthetic appreciation of the interplay of light and colour over sea and sky. It gives a clear explanation, fully abreast of modern theory, of weather changes and forecasting more particularly as applicable to the United States. Much attention is given to the production of rainfall by artificial means, especially the seeding of cumulus clouds with silver iodide; and it is emphasized that progress in this field must depend on the close application of meteorological knowledge to the problem. The extent to which rain-making on these lines is already being practised in the drier regions of the United States (and the resulting state laws) will certainly come as a surprise to many readers. In the last chapter "In partnership with Nature" the authors argue with dramatic force that with the ever-increasing pressure of human population upon water and food resources close cooperation with nature will be necessary if mankind is to survive on this planet. They close with exhorting meteorologists to tackle the still unsolved problems of the ionosphere and other high levels of the atmosphere which have a bearing on surface weather. A few minor criticisms seem called for.

In the simplified system of cloud classification used nothing is to be gained by reinstating the term *nimbus* (rain-cloud) which has been discarded in official international usage in favour of the more descriptive compound terms *strato-nimbus* for cloud producing steady frontal precipitation, and *cumulo-nimbus* for that generating showers and thunderstorms. The explanatory text to an excellent photograph on page 65 showing the conversion in the laboratory of water droplets into ice crystals needs clarification. In pointing to smog-ridden cities like London of old and Los Angeles more recently the authors state that in Great Britain smoke pollution in winter changes a naturally cloudy environment into one of "unrelieved gloom." This, of course, is a grossly misleading picture, for even London itself, to say nothing of the south coast of England, enjoys many an interval of bright sunny winter weather. L. C. W. B.

KULTURGEOGRAFISK ATLAS. Compiled by J. HUMLUM. *Copenhagen: Gyldendal*, 1955. 2 *Vols.* 10½×7 *inches.* ATLAS VOLUME only. *London: Meiklejohn*, 1955. 15*s*.

This is a reissue of Professor Humlum's well-known atlas of economic geography and for the first time text and maps have been published in separate volumes. This opportunity has been seized to increase the length of the text and at the same time the number and variety of the inset maps has been increased. This is a most valuable work and the atlas volume in particular, which has underlines and notes in Danish, German, French and English, should have a very wide circulation far beyond the bounds of Scandinavia. It is difficult in a short review to do justice to the great mass of accurate material which has been gathered together. The subjects treated range from population distribution to industrial activities with most of the statistics used for the maps for the years 1950–2. Crop and trade maps for the world are drawn on Olaf Kayser's projection with an enlarged insert for Europe. These maps, where it is appropriate, show details of trade and the limits of cultivation. All maps are printed in red and black and one of the virtues of the atlas is the skill with which the symbols have been inserted. Some of the plates show less generalized distributions and among these must be singled out Plates 104–5 which plot the areas of mineral

production in Central Europe. This view of the ore- and coal-fields together with the transport flow lines gives a most valuable synopsis of the industrial balance of Europe.

The text volume is in Danish and, lavishly illustrated by diagrams and photographs complementary to the written word, it provides a vivid and clear picture of the problems of life in so far as production for sale is concerned. Throughout one is impressed by the awareness of modern trends and information appears which is not yet current in British texts. One example must suffice; the map and accompanying text which describes the deflection of river systems, by means of a long tunnel, to provide the power for the new and expanding Canadian centre of aluminium smelting at Kitimat. Professor Humlum is to be congratulated on his new edition of an atlas which should be consulted by all interested in world affairs of production and trade

A. C. O.

## GENERAL

TO THE THIRD POLE. By G. O. DYHRENFURTH: translated from the German by Hugh Meyrick. *London: Werner Laurie*, 1955. 10×7 *inches;* xxvii+233 *pages; sketch maps, illustrations.* 30*s*

DU MONT BLANC A L'HIMALAYA. By GASTON RÉBUFFAT. *Paris: Arthaud*, 1955. 10×7½ *inches;* 158 *pages; illustrations*

Professor Dyhrenfurth's book 'Zum Dritten Pole,' published in 1952, has now been translated into English. As he explains in his preface, he uses the term "the Third Pole," not in the sense that Marcel Kurz used it some twenty years ago as meaning Mount Everest, but in the broader sense of all Himalayan peaks above 8000 metres; and he summarizes the various reconnaissances and attempts on the mountains which fall in this category, bringing the English edition up to date with the Everest success of 1953, and including a useful supplement on the 1954 operations. "Seven-thousanders" are dealt with in tabular form.

Everest takes the first two chapters. Most of the other nine giants have chapters to themselves. As might be expected from a Himalayan mountaineer of such experience the historical summaries of the climbs are vividly and competently told, though not everyone will agree with his conclusions where there was disaster or failure. Professor Dyhrenfurth introduces each narrative with a short note on the height and name of the peak concerned, and here he goes astray. It is a great pity that continental writers do not adopt the official heights of the Survey of India, which, though they can never be exact, are as precise as can be determined at present. For instance, on page 7, the author, discussing the height of Everest, mildly criticizes the Survey of India for adhering to the old figure of 29,002 feet, adding that he has "adopted the now generally accepted figure of 29,160 feet (8888 metres), which is probably nearer the truth." He even suggests "that the Assam earthquake, according to reports from India, may have added 200 feet" to Everest's height, though he wisely refrains from doing so. He does, however, "adjust" the heights of other peaks, such as Makalu, to his new height of Everest, though in fact the old geodetic observations of Makalu are in no sense dependent on those of Everest. This, I suggest, is playing fast and loose with theodolite observations. Dyhrenfurth's figure for Everest has *never* been the official or generally accepted figure in India or in England. That there was good reason for the Survey's conservatism is proved by the recent geodetic observations in Nepal, which give a height of 29,028 feet to Everest. The problem of Himalayan heights is extremely complex and continental writers would be well advised to accept the conclusions of competent Indian geodesists. The photographs are well chosen and produced, the sketch-maps are excellent, and the translation good, though the designation of the Survey of India on page 8 as the "Indian Land Measurement Department" gave me a jolt.

Gaston Rébuffat is perhaps the most daring and brilliant of the modern French school of young mountain guides; Maurice Herzog on Annapurna certainly owed his life to Rébuffat's devotion and self-sacrifice in 1950. His book has been described as

a "spiritual autobiography both of the author and of the sport of mountaineering," which is perhaps a little pompous and unfair. The ninety pages of text include a preface by M. Lucien Devies, and essays and thoughts of the author on the pioneers. Less than fifty pages are devoted to his own achievements. The illustrations, from many sources, are superbly reproduced. K. M.

A HISTORY OF FORTIFICATION: From 3000 B.C. to A.D. 1700. By SIDNEY TOY. *London: William Heinemann*, 1955. 9×6 *inches;* 255 *pages; illustrations and diagrams; index.* 30*s*

It is unfortunate that the author of this excellent work of reference chose these dates for the chronological scope of his work. It should more correctly have been entitled "A history of medieval fortification." It is true that his first chapter deals, somewhat superficially, with a few ancient fortresses in Babylonia, Egypt, Troy and Greece, but he throws no real light on prehistoric fortification and makes no mention whatever of the interesting "causewayed camps" of our neolithic ancestors. Incidentally, he describes the Zimbabwe ruins of Rhodesia as "prehistoric."

Chapters 2 to 5, which cover the classical and Byzantine periods, are almost equally unsatisfactory. Early Iron Age hill-forts are entirely neglected, if we except a cursory note on Maiden Castle, and slighter reference to brochs and vitrified forts. Chapter 4 on the fortifications of the Roman Empire is somewhat more informative, but he fails to bring out the dimensional difference between a *castra legionis*, such as Caerleon, and a *castellum*. Chapters 6 to 16, dealing with medieval fortifications from the fifth to the fifteenth centuries, could hardly be bettered and show an intimate knowledge of the subject, illustrated by very clear diagrams and photographs. When, however, the problem of fortification against artillery is reached, the book fails lamentably. On p. 236 "1356" is given as the date of Crecy, instead of 1346, 1356 being the date of Poitiers.

Although the author purports to carry his history of fortification up to 1700, he gives no example more modern than the forts of Walmer, Deal, Camber and Pendennis, built by Henry VIII in the mid-sixteenth century. Strange to say, no mention is made of that master of seventeenth century fortification, Maréchal de Vauban (1633–1707), who revolutionized the art of fortification against artillery fire, and introduced those complicated geometrical constructions of masonry protected by earthwork which provided the answer to siege artillery from the age of Marlborough till the Crimean War. J. H. M.-C.

ALICELLA. By AVERIL STEWART. *London: John Murray*, 1955. 8½×5½ *inches;* 330 *pages; illustrations.* 21*s*

This is the tale of two sisters, Alice and Ella, who lived in an era as remote from today as any, although they died so few years ago. Alice chose the road of devoted marriage and motherhood and carried the burdens of leadership in Scots society with a forceful gaiety and a profound sense of duty; and so did Ella, when she had seen the worlds she desired, which few had seen before her and so much of which is now, to us, forbidden or lost country. This world she shared faithfully with Alice, who saw it through her sharply observant eyes, by letter when she was far away and in conversation when she returned.

Now Alice's daughter-in-law, with consummate skill and a humour which would have delighted Alicella, has joined these two remarkable sisters in a book, which is a delight to read again and again. Those chapters which will most appeal to Fellows of the Society concern Ella's far journeying, into Tibet, to China and Japan, to Central Asia, the Oxus, Tashkent and Khiva, Bokhara and Samarkand. But once open this book and you will find that Ella's golden road turns, in a celtic twist, to Alice at Murdostoun, to the Japanese garden at Cowden and to the authoress, whose genius binds all within the covers of 'Alicella.' If you never knew Alicella, this book will leave you the richer by far more than the shadow of their great-hearted partnership.

BELHAVEN

## RECENT GERMAN PUBLICATIONS

Of the German geographical works lately received in the Library, the following are a representative selection. On the occasion of the meeting of the Deutschen Geographentag at Hamburg, in August 1955, a substantial volume of essays on the city and port was published under the editorship of Professor W. Brunger (HAMBURG : GROSZSTADT UND WELTHAVEN. *Kiel: F. Hirth*, 1955). Clearly and concisely, numerous specialists describe the natural setting of the city, the problems connected with the control of the Elbe and the maintenance of a sufficient navigation channel, the "Stadlandschaft," the water supply, port installations, social status of population, and overseas relations, with particular emphasis on the present—most, in fact, of the multifarious topics related to the functioning of a port of the first rank.

The volume prepared by Professor J. H. Schultze and his assistants applies methods of geographical and social research to an eminently practical problem; on what lines and on what scale should a town be reconstructed? The town in question is Jena, and the book answers a number of questions submitted to Dr. Schultze by the civic authorities. It deals with the probable future size, estimated at 90–100,000 in 1970; the reconstructions of the old centre and its relation to its environs; the direction and character of expansion; water supply and similar problems. In regard to future industrial growth, Dr. Schultze stresses the part which scientific research and precision engineering have played in the past, and urges that these should continue to be the standard, with avoidance of dangerous reliance on too limited a field. Future industries therefore should be optical and precision mechanics, tools, glass, building, printing and publishing. The study is worked out in great detail, and furnished with numerous maps in a pocket. (JENA: WERDEN, WACHSTUM UND ENTWICKLUNGSMÖGLICHKEITEN. *Jena: Gustav Fischer*, 1955. DM.32).

Oceanographical research has made notable advances recently, and present knowledge is summarized in DIE SIEBEN MEERE by Ernst Gagel (*Braunschwig: Westermann*, 1955. DM.18.60). This deals not only with physical oceanography but also with biology, and has some references to maritime commerce. It records the recovery of living organisms from depths exceeding 8000 metres, and sets out the contemporary view of the permanence of the ocean beds. The author has succeeded in his aim of simplicity, clarity and brevity.

Professor L. Alsdorf believes that the time is opportune for a general work on India, as sufficient results of the 1951 census are available, and the difficulties which must arise temporarily from the proposed territorial rearrangement are still in the future. (VORDERINDIEN: EINE LANDES- UND KULTURKUNDE. *Braunschweig: Westermann*, 1955. DM.22.) His book is intended as a reference book on the Indian subcontinent; consequently a relatively large amount of space is given to history, particularly recent history, political organization, and economic plans. He gives a generally impartial account of the long movement to independence. The second half of the book contains short sections on some twenty regional divisions, largely descriptive and statistical. Professor Alsdorf writes clearly and has obviously an extensive knowledge of the relevant literature. His book should fulfil the purpose for which it is intended.

The necessity for the rational treatment of the world's natural resources is now generally recognized. Karl Kruger treats the problem from an interesting standpoint in comprehensive fashion in INGENIEURE BAUEN DIE WELT (*Berlin: Safari Verlag*, 1955. D.M.19.50). The book is written to attract popular support, which will be necessary for the far-reaching changes which the author visualizes. Conservation and reclamation works, power production, housing outside the temperate regions, communications, and national planning are among the themes treated in an effective way. A number of interesting points are made, e.g. the need to adopt industrial techniques and machines to environments, other than that of western Europe, where they were evolved; the danger of centralization upsetting regional balances; the growing problem of water supply in heavily industrialized regions. There are many unusual photographs and a "Technogeographische Karte" of the world in colour. G. R. C.

# THE SOCIETY'S NEWS

## NEW YEAR'S HONOURS LIST

The award was announced in the New Year's Honours List of a C.B.E. to Commander C. J. W. Simpson, leader of the British North Greenland Expedition, and recipient of the Society's Founder's Medal for 1955. Commander Simpson is a Member of the Council of the Society.

## POLAR MEDAL AWARDS

It was announced in the *London Gazette* of 24 January 1956 that The Queen had approved the following awards to the Commonwealth members of the Norwegian–British–Swedish Antarctic Expedition, 1949–52: *Clasp to the Polar Medal*, Alan William Reece, Geologist; *Polar Medal (posthumous)*, John Ellis Jelbart, Physicist, and Corporal Leslie Arthur Quar, R.A.F., Radio Technician; *Polar Medal*, Gordon de Q. Robin, Ernest F. Roots, Charles W. M. Swithinbank. It is also announced from Canberra that the *Polar Medal* has been awarded to eight Australian scientists and technicians, members of the pioneer party which set up the Australian Antarctic Station at Mawson in 1954, and to the French observer accompanying them; a *Clasp* to the *Polar Medal* is awarded at the same time to Mr. Robert G. Dovers, Officer-in-Charge at Mawson.

## SPECIAL MEETINGS OF THE SOCIETY: SESSION 1955–6

On November 7 a joint meeting was held with the Alpine Club at the Royal Festival Hall, when Charles Evans, F.R.C.S., and George Band lectured on "Kangchenjunga climbed." Her Royal Highness the Duchess of Kent, Honorary President of the Society, was graciously pleased to attend, and members of the 1955 expedition to Kangchenjunga were presented. A report of the lecture and proceedings is to be found on pages 1–12 of this issue.

The Children's Meetings, on January 2 and 4, were as popular as ever. On Monday Jan. 2, David Attenborough spoke at 2.30 and at 5.30 on "Animal collecting in British Guiana," and showed a film of unique zoological and geographical interest. With the cooperation of the Zoological Society of London an exhibition was staged in the Society's House entitled "Putting animals on the map." During the first fortnight of January there were, ranged in cages and tanks round the walls of the Exhibition Gallery, a unique selection of small mammals, birds and reptiles, in charge of a Keeper from Regent's Park. Above the cages hung large maps of the continents, prepared in the Society's Drawing Office, to which a coloured streamer was attached from each animal's pen to show geographical distribution.

On Wednesday January 4 John Jackson lectured twice on "Kangchenjunga climbed," and illustrated the talk with lantern slides. Mr. Attenborough's two lectures were attended by 1400 people in all, of whom 1200 were children; Mr. Jackson's by 1150 in all, of whom 950 were children. The Exhibition was seen by over 3000 visitors, including several hundred geography teachers at the joint meeting with the Geographical Association and the Institute of British Geographers on January 3, and children from three schools. The Society is much indebted to the Zoological Society of London for enabling this very successful and unusual Exhibition to be arranged.

## EXPEDITIONS IN THE FIELD DURING 1955

Reports have been submitted to the Research Committee from eight expeditions to which financial grants were announced in the *Journal* for June 1955 (p. 237). Unless otherwise stated, the expeditions worked during the Long Vacation of 1955. Reports have also been received from five expeditions not aided financially by the Society, and all have been placed in the Library, where they can be consulted.

*Fox Photos Ltd.*

*Fox Photos Ltd.*

*Christmas Exhibition "Putting animals on the map." Below, a Brazilian tapir*

1. NOTTINGHAM UNIVERSITY NORTH-WEST SPITSBERGEN EXPEDITION, 1955

The main work of the expedition was carried out in and around King's Bay, and on the ice cap east of the bay, in bad weather conditions. The expedition, under the leadership of H. Mellor, was divided into a glaciological and a geological party. The glaciological team planted stakes on two sections of the King's Glacier system, and on the Blomstrand Glacier to the north of the bay, and later took flow measurements. Surveys were made in these areas. A 17-foot pit was dug in the firn on the Isachsen plateau at an altitude of 850 metres, a profile drawn and specific gravity determinations made. The party also went by boat to Cross Bay and mapped the ice cliffs of the Fourteenth of July Glacier. The geological team studied the rock formations to the north and east of King's Bay, where the topography is wild and alpine-like; the age of the rock examined ranged from Hecla Hoek to Carboniferous. A survey of the Loven Islands was also made.

2. OXFORD UNIVERSITY EXPEDITION TO NORTH EAST LAND, 1955

The expedition, continuing the work of earlier Oxford University Exploration Club Parties in North East Land, was led by J. T. Hollin. They left Sheerness on July 7 in H.M.S. *Vidal* and arrived back at Gourock on September 13. A map is filed with the Report showing the journeys made by the expedition during the two months in the field. A series of gravity stations was established on the West Ice, and preliminary calculations show that the ice thicknesses are greater than has been supposed. Four drilling stations were also established at which electrothermic drilling was carried out, as a continuation of S. S. Wilson's drillings on the Brasvelbreen in 1951; temperatures were measured at various depths in the West Ice. Seventeen holes were drilled in the marginal area of the ice sheet at 33 metres above sea level, at various depths down to 87 metres, and negative ice temperatures to a minimum of −90° were recorded. The measurements obtained complement those of the Oxford University Arctic Expedition, 1935–6, which demonstrated that at 500 metres above sea level in the accumulation area the negative belt disappears completely in summer. The major features of several of the larger land outcrops and islands were determined by theodolite and compass resections, marine soundings were made off the ice cliffs on either side of Brageneset, and echo-sounder traces obtained indicating of submarine relief.

3. CAMBRIDGE EXPEDITION TO AFGHANISTAN

The Cambridge Expedition to Afghanistan under the leadership of O. R. de Baer left Southend on June 15 and reached Kabul on July 19 by way of Strasbourg, Belgrade, Istanbul, Erzerum, Teheran, Meshed, Herat, Mazar-i-Sharif and Chariker. Owing to lack of permission from the Afghan authorities, the party was unable to visit the areas planned, and only after a number of set-backs were they allowed to go to Barak and the Kharisbad Plain. Here they spent two weeks carrying out as extensive a geographical survey as was possible. The people were Tajiks, and the Badakshan authorities assured members of the expedition that they were the first Europeans to have visited many of the Tajik-occupied valleys.

4. CAMBRIDGE EAST GREENLAND EXPEDITION, 1955

The aims of the expedition led by J. H. Latter were: to ring Pink-footed and Barnacle geese, and any other birds they might find, as part of a general enquiry into Arctic migration; to make a systematic collection of rocks, including fluvio-glacial sands; and to do some general ethnological, botanical and zoological collecting.

5. AGRICULTURAL AND HISTORICAL GEOGRAPHY IN YUGOSLAVIA

H. J. Savory made a preliminary visit to the three areas of Grohote Polje on the island of Šolta, Dūgo Polje on the mainland near Split, and Glamočko Polje in Bosnia. Concentrating on Glamočko Polje, his report on this district covers the physical and historical geography, the form and distribution of settlement and the economic life. The Report contains maps, diagrams and photographs.

6. OXFORD UNIVERSITY EXPEDITION TO SOUTHERN MOROCCO, 1955

The expedition, with B. C. Clarke as leader, studied a selected region of the High Atlas, making comparisons between the well-watered northern slopes of the mountains and the drier southern ones. The party spent seven weeks in Idirh, a village of the Glawa tribe near the Kasbah of Telouet. A land use map was made of the village and various aspects of village life studied. Some 3500 zoological specimens were collected, and samples of local arts and crafts were obtained for the Pitt Rivers and Ashmoleam Museums. J. Newbould and C. Pennycuick were able at different times to make a journey into the mountains with Wilfred Thesiger, who was travelling independently in the High Atlas.

7. ANGLO-NORWEGIAN-AMERICAN FROZEN GROUND RESEARCH EXPEDITION, 1955

P. G. Williams's party from Cambridge, Oslo and Yale continued last year's work on solifluction phenomena in northern Norway, with investigations in mountain areas of Dovrefjell, Trollheimen and Rondane. A newly constructed apparatus for detecting minute soil movements, based on the use of electrical resistance strain gauges, was tried out. An electrical resistance thermometer, the thermistor, was found to fulfil the need for a full measuring instrument of great sensitivity in the study of ground freezing and thawing processes. Investigations of piping laid down in solifluction terraces in 1954 in the Reinheim area showed clear evidence of soil movements. Soil samples for grain size and other analysis were collected.

8. DURHAM UNIVERSITY EXPLORATION SOCIETY

The Durham Exploration Society sent out five expeditions during 1955, including one (led by D. H. Frolich) to Iceland; this had for its aim the continuance of a study of Tindfjallajokull, a small ice cap some 10 square miles in area in the south-west of Iceland. The objects were: To complete a survey of the whole glacier on the 1/25,000 scale; to study ablation, movement of ice in the glacier tongues, and glacial profiles; to compile a report on local weather conditions; to continue the zoological survey of previous workers; to continue last year's geological survey. Despite unusually bad weather conditions (the worst since observations began in 1876) the intended programme was successfully concluded with the exception of the survey work.

Full reports have also been received of the Durham University explorations to Norway (1955), to Soleimajokull, Iceland (1955), Cairngorms (1955) and Eire (1955).

9. CAMBRIDGE UNIVERSITY TIBESTI RECONNAISSANCE EXPEDITION, 1955

Mr. and Mrs. Akester, Mr. I. G. Gibson and Mr. E. M. Scratton aimed to make a general survey of the route from the North African Coast to the Tibesti country south of Gatroun (described as "the furthest south centre of civilization in Lybia"). The party was away from July 21 to September 17, except for Mr. Gibson, who returned in November, and much information was collected as to ways and means of travel; photographs were taken and contacts made, all of which are designed to assist the travel of future expeditions. The Report is in two parts: Part I covers the ground to Sebha, and concludes with a proposal for a full-scale expedition in 1957; Part II is by I. G. Gibson who alone went on to Zouar in the Tibesti.

GRANTS TO EXPEDITIONS FROM GEOGRAPHICAL MAGAZINE TRUST

In addition to grants to expeditions from the Society's own funds (£1000 to the Trans-Antarctic Expedition, £1130 in smaller grants) the following were sanctioned during 1955 from the Geographical Magazine Trust: Oxford University Exploration Club expedition to Sarawak, £100; O.U.E.C. expedition to South Morocco, £50; J. B. Heaney for scientific work on Gough Island in the South Atlantic, £100; Cambridge Expedition to Afghanistan, £75; British School at Athens underwater archeological and geographical exploration, £75; Trans-Antarctic Expedition, £400.

## NEW PUBLICATIONS

### ROYAL GEOGRAPHICAL SOCIETY: A RECORD, 1931–55

A review of the Society's activities during the last twenty-five years has been published to mark the 125th Anniversary in 1955. This review, collated by G. R. Crone, Librarian and Map Curator, brings up to date the Record of the Society's first century, written by Dr. H. R Mill for the centenary celebrations in 1930. 'Royal Geographical Society a record: 1931–55' is on sale at 3*s* post free, or 2*s* to Fellows at the Society's House. Some copies of Dr. Mill's work are still available, at 25*s* each (20*s* to Fellows) plus postage.

### NEW GEOGRAPHICAL LITERATURE AND MAPS

The tenth number of this list of accessions to the Society's Library and Map Room was published in early January. This completed Volume I, 1951–5, and a title-page was issued with it. In all, the volume contains some 4500 entries relating to books and papers in periodicals, and all new atlases and current maps received. Though the usefulness of this guide to current geographical publications is generally recognized, the support it receives might well be much greater. Two numbers are published each year, and the annual subscription remains at the low figure of 7*s* 6*d* post free from the office of the Society.

# THE RECORD

## CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

*Charles Evans*, deputy leader on Everest in 1953, led the successful Kangchenjunga Reconnaissance, 1955; *George Band*, the youngest member of the Everest team, was one of the first two climbers to arrive within range of the Kangchenjunga summit. *Geoffrey Hattersley-Smith* served with the Falkland Islands Dependencies Survey from 1948 to 1950, and is now with the Defence Scientific Service of Canada, which he joined in 1951. *G. B. G. Bull* is Senior Lecturer in Geography at Goldsmiths College, University of London. *Phillip Law* is Director of the Antarctic Division of the Australian Department of External Affairs, and has been actively engaged in Antarctic research and exploration since 1947. *Kenneth Lee Wallwork* holds a research studentship at Manchester University; he won the Society's Essay Prize in 1955 with the paper which is printed here. *R. D. Hayes*, at the time of the field work described in his paper, was reading geography at St. John's College, Cambridge. *Gareth Thomas* is on the staff of the Department of Geography and Anthropology at Aberystwyth. *J. W. Pallister* was formerly Lecturer in Geology in the University of Birmingham, and is now Assistant Director of the Geological Survey of Uganda. *C. R. Twidale*, after studying geomorphological problems in Australia from 1952–5, is now with McGill University working on physiographic problems in Central Labrador. *Wilhelm Kick* is a geodesist who worked on glacier research in the eastern Alps with Professor R. Finsterwalder.

## THIS YEAR'S EXPEDITIONS TO ANTARCTICA

In November last, two British expeditions left this country to set up bases on the Antarctic Continent at Vahsel Bay in the Weddell Sea. The first was the advance party of the Trans-Antarctic Expedition under the leadership of Dr. Vivian Fuchs. The expedition ship, the M.V. *Theron*, also carried Sir Edmund Hillary, the leader of the New Zealand section of the expedition, and an R.A.F. flight of two Auster aircraft and crews, under the command of Squadron-Leader Lewis, R.A.F. For

twenty-three days in January the expedition was in considerable difficulties in the ice of the Weddell Sea and was forced to drift off her course far to the north-west, following the current of the Weddell Sea, which was for some time reinforced by a strong easterly wind. Towards the end of the month an isolated patch of open water enabled one of the Austers to undertake a reconnaissance. This, together with the assistance of helicopter flights from H.M.S. *Protector*, which undertook ice reconnaissances at Dr. Fuchs's request, enabled the *Theron* to reach open water. Taking a more easterly course than on the first occasion, the Expedition's ship succeeded in reaching Vahsel Bay on January 29 where "Shackleton Base" was set up in preparation for the arrival of the main party in 1957 (lat. 77° 57′ S., long. 37° 16′ W.). The *Theron* sailed for South Georgia on February 7 and should reach this country by March.

The Trans-Antarctic Expedition received an initial grant of £1000 from the Society in its early planning stages in 1954 and has since received a grant of £400 from the Geographical Magazine Trustees.

The second expedition, the advance party of the Royal Society's expedition under Surgeon-Commander Dagleish, R.N., sailed a week later for the Antarctic on board the sealer *Tottan*. Being in radio contact with the *Theron*, Surgeon-Commander Dagleish presumably had the advantage of Dr. Fuchs's warning signals and, on that account, may have taken a more easterly course, enabling his ship to reach the Caird Coast before the *Theron*, in the first half of January. This second expedition is the advance party of the expedition which is the United Kingdom's Antarctic contribution to the International Geophysical Year. It will be primarily a static expedition, and the site finally chosen by Surgeon-Commander Dagleish for his base is as suitable for scientific investigations as the original site proposed at Vahsel Bay, further to the south.

At the other side of the continent in the Ross Sea area, the advance parties of the American Antarctic Expedition contributing to the International Geophysical Year have been very active, especially in exploration by air. For the first time in Antarctic history four heavy aircraft (Skymasters) were flown direct from New Zealand to Antarctica, landing near the expedition's base in MacMurdo Sound. Before leaving on the break-up of the ice in January, each of the aircraft had made five flights over the continent, and in eight days covered approximately a million square miles of Antarctica. Flights were made over the Geographical South Pole (where a meteorological station is to be set up), over the South Magnetic Pole and over the "Pole of Inaccessibility." Lieutenant-Commander Torbert, U.S.N., made the longest flight ever attempted in the Antarctic. On January 12, in a Neptune Flying Boat, he flew from MacMurdo Sound across the South Pole to the Weddell Sea, and back. This double trans-Antarctic flight of 2400 miles in all took 19½ hours of continuous flying. Lieutenant-Commander Torbert's achievement marks an epoch in the history of Antarctic exploration by air.

## UNIVERSITY NEWS

### UNIVERSITY OF CAMBRIDGE

Professor J. A. Steers, Professor of Geography in the University, has been elected Chairman of the Committee of Management of the Scott Polar Research Institute in succession to Mr. J. M. Wordie, whose long and valuable services to the Institute as Chairman extended over a period of nearly twenty years.

## INTERNATIONAL GEOGRAPHICAL CONGRESS, 1956

The Eighteenth International Geographical Congress, which opens at Rio de Janeiro on August 8, will be attended by a small British delegation led by Professor J. A. Steers. The programme was briefly summarized in the September 1954 issue of the *Journal*; the list of proposed papers, mentioned in the *Journal* of December 1955, has now been received at the Society and may be consulted by anyone interested.

## MOUNT EVEREST FILMSTRIPS

Two excellent filmstrips have been produced by Educational Productions Ltd., with the cooperation of the Royal Geographical Society and the Alpine Club, Wilfred Noyce acting as Technical Adviser and Dr. E. W. H. Briault as Educational Adviser. A proportion of royalties earned is to be paid to the Mount Everest Foundation. The strips, which are in Eastman Colour and cost 25*s*. each, are called "Through Nepal to Everest" (49 frames) and "The Ascent of Everest" (40 frames). Schools and other educational institutions, as well as the general public, are greatly privileged in having these two superb filmstrips made easily available to them, and that at a modest price. The pictures, in vivid colours, are of excellent quality, and one can but marvel at the skill and dexterity of the cameraman who took the original photographs, many of them under conditions of appalling difficulty. Wilfred Noyce, a schoolmaster and writer, and a member of the Expedition, selected the pictures and arranged their sequence in both strips; he also compiled the two sets of descriptive notes—lucid, concise and to the point.

The two strips differ somewhat from the general run of geography teaching strips, yet both can be used with great advantage in secondary schools and at higher levels. The pictures taken on the journey through Nepal are of immense value, which is enhanced by the factual information provided in the notes. We are not likely to see another filmstrip on this region for a long time. Certain aspects of Mountain Geography are superbly illustrated, and by no means the least interesting frames are those that show how the Expedition depended on coolie labour to carry supplies over difficult country and upon high altitude Sherpa porters for the greater heights. Both strips, naturally, present magnificent views of a variety of glacial phenomena: glaciers, crevasses, icefalls with countless crevasses and seracs or pinnacles, snow bridges and cornices—masses of overhanging snow or ice along the ridges. These strips can also be the means of inspiring the more mature pupils, as well as members of discussion groups and youth clubs, and set them thinking about those factors that move men to attempt great and heroic tasks, and the motives which led the Expedition to undertake the assault upon the world's highest mountain. Should a member of a class or group be sufficiently interrogative to ask the question: "Why should men risk their lives in such a venture?"—the teacher or leader will be provided with a golden opportunity to answer that so long as Everest remained unconquered it presented a unique challenge to human courage, and a challenge to human skill. The climax is portrayed in the picture of Tenzing standing on the summit and holding aloft the flags of United Nations, Britain, India and Nepal attached to his ice-axe. To secure this photograph Sir Edmund Hillary, standing at the prodigious height of 29,000 feet, took off his oxygen mask. This is the picture that made history—British history—and how the hearts of millions thrilled to the news of the "Conquest of Everest" at the time of the Queen's coronation, when the British nation and the peoples of the Commonwealth entered upon the second Elizabethan age. E. R. D.

## SOME IRISH MAPS, 1837–49

The article by Professor Robinson in the *Journal* for December 1955, on the 1837 maps of Henry Drury Harness, calls attention to some of the remarkable maps of Ireland produced by British officers investigating the railway planning of the day. There was in Ireland an acknowledged need for better communications, even though the country's roads compared favourably with those of Britain: the canals too were well patronized both by passenger and goods services. When Harness produced his maps in 1837, the only railway was the short but profitable line from Dublin to Kingstown, opened in 1834: the aim was to find out what network of railways would be likely to succeed, by drawing traffic from the roads. Canals were regarded as likely competitors of the railways, at least for goods, and writers such as Sir Robert Kane ('Industrial Resources of Ireland,' Dublin, 1844) agreed that more canals should be built. At the first (1836) Commission one party wished to run the Dublin–Belfast

line inland, through Navan and Armagh, and the other to take a coastal route, through the ports of Drogheda and Dundalk. And this effort to find the best routes led to the great interest in population distribution by Harness and others: for example, the advocates of the inland railway from Dublin to Belfast said that there were "a large number of communities, small individually, but in total substantial," while along the coast there were "merely . . . a few villages and fishermen's huts." The advocates of the coastal railway said that the inland route must fail as there was "a view of beggary on every side," with "thatched cottages and nothing but misery" but the coast had a population "almost industrial in its density" (T. W. Freeman, 'Ireland,' 1950, p. 246).

Harness and others (if there were others) produced the 1837 maps to show the relevant factors in the situation. They were planners: having no directives on map production, they used their own good sense. Harness, unlike scores of his successors, eliminated with considerable accuracy the unpopulated areas of Ireland though he failed to show the extremely high densities characteristic of the western coastlands, probably because the 1831 Census recorded these remote communities inadequately. Petermann, in his map of 1849, noted by Robinson as the second shaded map, used the excellent 1841 Irish Census but made the curious mistake of assuming that the country's population had increased continuously from 1841–9, though from 1846 the Irish Famine, of which he can scarcely have been ignorant, caused so many deaths and so large a volume of emigration that the population declined heavily after 1845: the figures are: 8,175,124 in 1841 but 6,552,392 in 1851 and probably at least 8·5 M. in 1845. Petermann excluded the unoccupied areas, and introduced the use of circles filled with colour for towns of various sizes: in his table on the map, he gave the 'computed population' of Ireland in January 1849 as 8,495,589.

Meanwhile the 1841 Census, produced by the commissioners W. Tighe Hamilton, Henry J. Brownrigg and Thomas A. Larcom, and published in 1843, included four distribution maps, a coloured map of Dublin and a series of graphs. The 'Report of the Commissioners appointed to take the census of Ireland for the year 1841' (Dublin, 1843 (esp. p. vi) includes the saying "A census should be a Social Survey, not a bare enumeration," and three of the maps, obviously social, dealt with housing, education and the value of stock. These three, and the population density map, used horizontal lines in five grades of thickness: unfortunately they spread their distributions over the whole area, making no allowance for the third of Ireland then as now unoccupied. All are on a scale of about 1/1,650,000 and fit neatly over a page 13 inches by 8·3 inches: happily Ireland's shape seems designed by nature for page reproduction. Each county was divided into a number of baronies, which in turn were divided into parishes: this system survived till 1898, when the English system of rural districts was applied in Ireland ('Saorstat Eireann, Census of Population, 1926,' vol. X, General Report, Dublin 1934, p. 4).

To consider each map in the Census Report in turn: (*a*) Plate I, *Population*, gives the density figures as well as shading for each barony with the population of every town having more than 2000 inhabitants: the most densely peopled areas have the darkest shade and a table shows the area of the country having each of the five densities, together with the areas of arable (improved) land, waste and water for each of the five categories; (*b*) Plate II, *House accommodation*, shows the percentage of houses in the fourth ('Census 1841 Report,' p. xiv) or worst group ("mud cabins having only one room . . . a mere hut") in each barony: the same five-line shadings are used with the worst areas darkest, and a statistical table gives the average of the four classes of houses for each county; (*c*) Plate III, *Education*, using the same method, maps the percentage of people who could neither read nor write: here again, the darkest symbol is appropriately used for baronies with over 80 per cent. illiterate, of which there were several in the west: on the other hand, some baronies in the east of Ulster had as few as 11 per cent. illiterate, shown in the lightest of symbols. As the Census Commissioners say, "For the purpose of conveying to the eye a general representation of the degree in which total ignorance of elementary instruction still

prevails . . . we annex a shaded map, by which it will be seen that, in a large portion of the island there is still considerable darkness" (*Ibid.*, p. xxxiii). A table for counties is attached. (*d*) Plate IV, *Property* (*live stock*), is perhaps the most ingenious if also the least reliable of the group. Having discovered the number of stock on all the farms of the country, the value per 100 acres is calculated for every barony with the same five-grade line shading of the other maps: the areas apparently richest are shown in the deepest shading, a departure from the convention of the three previous maps in which the least fortunate areas are shrouded in darkness. The estimated value of stock was: horses and mules £8 each, asses £1, cattle £6 10*s*. 0*d*., sheep £1 2*s*. 0*s*., pigs £1 5*s*. 0*d*. and poultry 6*d*. Obviously there is no such thing as a standard cow, and the map seems naïve. Oddly enough the Census does not give the figures for individual baronies on which this map is based, but only those for counties and for farms of various sizes. Finally a series of graphs shows the number of people, by sex, rural and town population, of each age. At every ten years, 20, 30, 40, 50, 60, there is a major peak, and at each intervening five years a minor peak: even now some Irish people have only a vague idea of their age, but a population of whom 53 per cent. were illiterate would be less certain. The Census Commissioners, however, draw a smooth curve through the graphs to show the reasonable distribution.

Dublin is given a special map with some interesting information on its main streets, including those of a residential character. Colours inserted by hand are used for a six-fold classification, first- and second-class "private streets," first, second and third classes of "shop streets" and "mixed streets" of the third class—which means very poor streets. This subdivision cannot have been easy to make, and one hint of the difficulty is given by the use of two colours for the two sides of the same street. But it gives interesting information on the town land use of Dublin in 1841, partly because it shows that some streets now decayed were then favoured residential areas. It is also a forerunner of the qualitative mapping in the famous surveys edited by C. Booth, published in London in 1892 under the title 'Life and Labour of the People of London,' in which the streets of London were given coloured symbols ranging from black, for the "lowest class . . . vicious, semi-criminal," to yellow, for the "upper-middle and upper-class wealthy families . . . wealthy . . . with three or more servants" and "houses rated at £100 or more."

Further investigation of these and other maps in Irish official publications would be fruitful. Those noted here are of great interest and also of considerable beauty; they are also anonymous. They show unequivocally the wide range of social and economic conditions then characteristic of Ireland—and still characteristic. And the Census Commissioners were well aware of the relationship between the maps: they say, for example, that "bad house-accommodation and defective education seem to accompany each other . . . the removal of either would be soon followed by the amelioration of the other" (Census 1841 Report, p. xxxiii). The maps are far superior to any in modern census volumes. Meanwhile from 1830–42 all the 6 inch to one mile topographical maps of Ireland appeared: as Professor Robinson rightly shows, this was an age of noble cartography.

T. W. F.

## THE STANDING CONFERENCE FOR LOCAL HISTORY

The Standing Conference for Local History, organized by the National Council of Social Service, took place on 14 December 1955 at Friends House, Euston Road, under the chairmanship of Sir Stephen Tallents, K.C.M.G., C.B., C.B.E., who was re-elected Chairman for 1956. The theme of this year's conference was "The influence of geography on local history." Professor E. G. Bowen, Department of Geography and Anthropology, University College of Wales, Aberystwyth, set the scene in a lucid and stimulating exposition of "The place of geography in local history," illustrating his points with lantern slides. The geographer's role, contended Professor Bowen, is threefold: illustrative, interpretive and creative, and he gave examples from the highland zone of Britain, both in town and country. Here, for instance, was Dyffryn

Farm, in Montgomeryshire, showing the varying division of the fields into arable and pasture in 1845, 1932, 1942 and 1952. Thus by maps the geographer illustrates: and, from his knowledge of the earth's conformation, interprets such facts as that, throughout the changes in use of the fields, three have never been other than arable. A map of Carmarthen town, showing the extent and nature of the buildings in the seventeenth, eighteenth, nineteenth and twentieth centuries, displayed the geographer, by means of cartographic techniques, as both illustrator and interpreter of the scene. Professor Bowen chose his own subject of the settlements of the Celtic religious communities in Wales as an instance of the creative work possible to the geographer. With the aid of a few simple maps he reconstructed something of the history of the cult of St. Carantoc, with special reference to a church at Llangranog on the west coast of Wales dedicated to this saint.

Having focused the attention of the Conference on the scene, and on the general principles governing the use of geography in relation to local history, Professor Bowen handed the audience over to Professor Darby, Department of Geography, University College, London, who spoke on "Domesday Geography." Professor Darby, interpreter and creator, speaking *con amore* of an England where woodlands were equated with herds of swine, and land measured in plough-teams, warned his hearers against thinking there was any easy way through the complexities and inconsistencies of Domesday Book. Although Domesday may be "the most remarkable statistical document in the history of the world," it is not, even after a century of careful editing, a straightforward one. Professor Darby showed three groups of slides, mostly of maps incorporating the information in Domesday: the first group to show the general picture; the second local peculiarities (such as the Worcestershire salt-pans); and the third to illustrate the variety of terms which may be used to measure any one feature—for instance, the assessment of woodlands in the east of England by the number of swine pastured and in the western midlands by linear measurements. The speaker concluded with the modest claim that when his own great work, in progress now for some twenty years, was complete, only "the roughest generalization" would emerge; then the foundations would be laid for detailed local research.

Mr. C. W. Phillips, Archaeology Officer for the Ordnance Survey, spoke after lunch on the work of his department, which is no less than to compile a national record of archaeological topography for Great Britain—a task the speaker hoped might be brought to a fairly advanced stage by 1965. The pre-war staff of six has increased to forty-five since the reorganization in 1946, and is divided into three groups—field investigation, record and revision. A number of voluntary correspondents supplement the official findings. Mr. Phillips gave some idea of the vastness of the field by including in his purview the coins of the first century, stamped with Nero's head, to be found in some of the estuaries of South Devon, and the relics of so recent an event as the Industrial Revolution.

Mr. R. Douch, Lecturer in Local History at the University of Southampton, chose southern Hampshire as his subject, and indicated the influence of geography on its history. So thoroughly did Mr. Douch play devil's advocate that he had to meet a challenge in the subsequent discussion of ignoring the historical aspect. Indeed, had there been time to prolong the debate, there would have been ample material in the day's lectures from which to elaborate the classic rivalry between the imponderability of those traditions and recorded facts we call history, and the inescapable realities of the geographical scene.

The conference room was decorated with maps of the sixteenth, seventeenth and eighteenth centuries lent by the Kent County Archives and from Sussex, and some interesting old scrapbooks, also from Kent. D. M.

## POLISH MAP COLLECTION

The map collection of the Central Archive of Ancient Documents (Archiwum Glowne Akt Dawnych), Warsaw, which suffered little damage during the war, has had

various private collections incorporated in it, and is being arranged and catalogued. It now contains about 30,000 manuscript maps and plans from the eighteenth to the early twentieth century. There are three main groups of materials. First, the topographic maps of Poland initiated by King Stanislaw Augustus Poniatowski. These were made under the direction of Karol Perthées—French by origin and probably related to the German cartographers—assisted by F. F. Czaka and J. Bakalowicz. These were on the scale of 1/220,000; and followed in essentials the Cassini survey of France. Owing to the partitioning of the country they were never published as a whole, though five were engraved by A. F. Tardieu in Paris. Another project which was frustrated by events was a map based on Michal Poniatowski's 'Statistical description of Polish parishes,' 1783–87, of which one volume has survived. There are also maps of the boundaries of the partitions, including Metzburg's map of Western Galicia, 1/72,000. The second group, about two-thirds of the whole collection, consists of plans of villages, mainly mid-nineteenth century, but some from the early eighteenth century. These are cadastral plans prepared for taxation purposes. Finally there are large-scale municipal plans, including one thousand relating to Warsaw and its neighbourhood, plans for early industrial installations, and architectural drawings. The collection is evidently of considerable importance for the human geography as well as the cartography of Poland. Its contents are described by Daniela Warecka, with reproductions, in 'Kwart. historii kultury materialnej' vol. 3 (no. 2), 1955, pp. 435–44.

## GLACIERS OF THE PAMIRS

The practical reason for studying the glaciers of Soviet Central Asia lies in their importance in water supply problems and therefore in current Soviet irrigation projects. R. D. Zabirov, who was doing field work in the Pamirs from 1943 to 1952, aims, in a recently published book, to give a general description of their glaciers, which total about 8000 square kilometres in surface area, or about 11 per cent. of the whole mountain region (OLEDENENIYE PAMIRA (Glaciation of the Pamirs). *Moscow: Gosudarstvennoye Izdatel'stvo Geograficheskoy Literatury* (State Publishing House for Geographical Literature), 1955).

The first part of the book describes existing glaciers; the second the ancient extent of glaciation; and the third, a kind of appendix, is a "catalogue of glaciers," in which the following data for 1172 glaciers are given in tabular form: name, location, type, length, breadth, surface area, height above sea level of snout and of snow line, name of first describer, and remarks. All this is based on the author's own field work and on careful search of the best available information. Descriptive works of this kind are the necessary first step in any study of the behaviour of glaciers and their effect on other natural phenomena. The real task is therefore only just beginning. But since the area is large, even this beginning represents a great deal of work (there is a bibliography of 300 entries), which is now being carried forward with vigour by a number of interested Soviet institutions. T. E. A.

## THE SARIYAR BARRAGE: HYDRO-ELECTRIC SCHEMES IN ANATOLIA

Increase of power production is one of modern Turkey's greatest problems; it is essential if she is to maintain her present rapid progress towards industrialization and mechanization of agriculture and thus a higher living standard, economic stability and national independence. This, in a country poor in power resources, requires a large initial outlay, which the country might be unable to raise were it not for foreign aid which helps to finance the development programmes. The marginal areas of Turkey are in a relatively favourable position in regard to power production, as they are in most other respects. In the north are the country's coal reserves between Ereğli and Zonguldak; but transport over the Pontic-rim is costly, and the deposits are difficult to work. On all coasts there is scope for the development of hydro-electricity. In the south-east near Raman and Garzan (north-west Mosul) 69,354 tons of petrol were produced in 1954, and further prospecting is expected to yield good results.

The semi-arid steppelands of inner Anatolia, however, were a poor, backward area till the far-sighted transfer of the capital from Istanbul to Ankara provided a centre for their development. The weak heart of Turkey began to beat more strongly, and modern economic development began to open up the most westerly of the dry intermont plateaux of Asia. Today industries are growing up in smaller Anatolian towns such as Eskişehir. Tractors are becoming more common even in the dry Konya basin, and are making extensive dry-farming possible where formerly poor peasants and half-starved animals raised meagre subsistance crops on small fields. To further this development inner Anatolia must tap all her potential power-resources. Prospecting for further workable lignite deposits is being carried on near Kütahya and Tavşanlı, and with American aid the construction of two power-dams has started on the Sakarya and the Kizilirmak.

The production of hydro-electricity in Inner Anatolia (which only receives 400 mm. of rain or less, falling in sporadic showers, and where shallow silt-laden rivers flow sluggishly between gravel-banks, frequently over limestone floors) seems a geographical absurdity. And yet the Sarıyar Barrage after its completion in 1957 will produce 360,000,000 kw. per annum, which will be transmitted as far as Ankara, Adapazarı, Istanbul and Kırıkkale. Work on the Sarıyar Barrage was started two years ago near Nallıhan, where the river, incised deeply into crystalline limestone pierced by volcanic intrusions, makes a sharp bend. Two tunnels have been excavated through the spur around which it flows. The lower, the deviation-tunnel, diverts the river during dam construction. The higher, the power-tunnel, will take the overflow from the reservoir and conduct it to the power-station on the downstream side of the spur, thus increasing the head to the turbines by 6 or 7 m. The dam has a width of 250 m. at its base, 60 m. at its top and will be 106 m. high (Hoover dam, U.S.A., 180 m.). Giant buckets on steel cables convey the concrete from the mixing plant and pour it into huge blocks. Above the site an American rock-cracking and grading plant has been installed, scarring the valley side and producing sand and gravel for the concrete-mixers. A white cloud of limestone dust rises from the valley and indicates the site from a great distance. As the limestones as well as the volcanic rocks are rich in joints, grouting on a large scale is necessary to prevent excessive loss by seepage in the tunnel, and to give the dam a firm foundation.

Beyond the spur the power house is under construction. In it four turbines (65,000 h.p. each) will receive water at the rate of 240 m.$^3$/sec. from the power-tunnel. Along the Ankara–Istanbul road and from other towns of the future grid the steel-structures of the transmission line are advancing towards Sarıyar. Near the old village of Sarıyar a modern settlement of huts and temporary houses has been erected for approximately 3000 people: Turks, Americans and Germans. It has a school, a hospital and a cinema; but in spite of all its modern amenities life in this isolated valley-section, where in summer the temperature rises above 40° C., may be very trying at times, and some of the engineers do not get into a town for three or four months at a time. Sarıyar village has benefited greatly from this development, as temporarily, while the river is diverted its fields cannot be irrigated, motor-pumps have been installed to replace the ancient water-wheels. Electricity has been laid on from the temporary Diesel power station, and a good road now links it to the main Istanbul–Ankara Highway. Transport to the site must have presented a formidable problem. 160,000 tons of cement alone, some of it from Sweden, had to be brought by lorry. The complete scheme will include further dam constructions on the Sakarya, and will not only provide large parts of north-west Anatolia with hydro-electricity but should modify the landscape itself. The seasonal precipitations will be stored and the run-off in the central and upper Sakarya basin will be reduced. This should raise the ground-water table in the limestones and marles surrounding the lake considerably, thus improving the conditions for forestry and agriculture. On the other hand much of the alluvial land today under rice, vegetables, wheat and tree-crops on the Sakarya flood-plain will be flooded when the lake fills up. More intensive

cultivation will shift to the shoulders and terraces above the river. Reforestation of the slopes should start at a later stage. This will reduce run-off, soil erosion, further dessication of the area, and silting up of the lake. Later the lake may become a holiday area for Ankara, from which it is 165 kilometres away. L. N.

## GEOGRAPHY AND ITS HISTORY

In his presidential address to Section E (Geography) at Bristol, Mr. J. N. L. Baker made some pertinent remarks on "Geography and its history." He was combating a common attitude that regards geography as a "new" subject, consequently deprecating the work of earlier generations, and at the same time is despondent about its present status. Mr. Baker showed, by quoting the examples of Buache and Busching, that geographers were constantly producing what they regarded as "new" geographies, and quite correctly, in so far as they dealt with new facts. At the same time, many of their ideas could not be regarded as wholly original. Buache in his 'Essai de géographie physique' (1752) probably derived his theories from Kircher's 'Mundus subterraneus' (1665). Mr. Baker then showed by quotations from Milton, Locke and Dr. Johnson, that contemporaries, far from neglecting geography, regarded it as a necessary branch of education for many walks of life: and, further, that writers such as Marlowe and Milton assumed a quite detailed knowledge of geography on the part of their readers. The quotations include an interesting extract from a letter by the poet Shelley describing Alpine glaciers. The modern contribution of geography to practical affairs is no new feature; geography has always had a practical side, in specialized subjects such as navigation and in the wider sphere of national life. For long periods, however, "there have been no geographers in the technical sense of the word." From his historical survey Mr. Baker concludes that there are "many geographies and many kinds of geographers." To restrict the term geographer to those who support a particular idea of geography is to be "unreasonably assertive in our belief and unjustifiably arrogant in our assertion of it. Geography has in the past had room for all who are prepared to contribute to it." Mr. Baker's address is printed in the *Advancement of Science*, Vol. 12, No. 46. G. R. C.

## ELECTRICITY FROM PEAT IN IRELAND

At no time has the use of Irish peat been greater than now. Coal costs more than four times as much as in 1938 and will shortly cost even more: peat is already made into patent fuel and used to fire electricity generating stations situated beside the bogs. Having long been recognized as a natural resource abundantly present, over-abundantly perhaps, peat came into its own during the Second World War when coal and oil were not generally available. To organize both the sale of peat to the consumer and its industrial use, the Turf Development Board (Bord na Mona) was established in 1935: the twenty years since then have seen an attack on peat-bogs that seems likely to clear some of the large ones for ever from the landscape. Already two peat-fired generating stations at Allenwood, Co. Kildare, and Portarlington, Co. Offaly, supply one-fifth of the country's electricity and ten more peat-fired stations will be opened between 1956 and 1960. Of these, three in Co. Offaly and two in Co. Mayo will depend on briquettes and one at Lanesborough will use machine-cut sod peat. Four other small stations in the extreme west, at Gweedore, Co. Donegal, Screeb, Co. Galway, Miltown Malbay, Co. Clare, and Cahersiveen, Co. Kerry, use hand-cut peat. It would be hard to imagine a more remote location for power-generation: Screeb, Co. Galway, for example, stands deep in Connemara on an arm of Kilkieran Bay, surrounded by small cottage farms and peat-bogs which are not of sufficient size to be exploited by expensive automatic plant but are of immense capacity in the aggregate.

Such developments are arresting, but the main onslaught on the bogs is made by the farmers, who normally draw some 3,000,000 tons of peat annually, compared with one-quarter of this amount produced by Bord na Mona. By 1961, however, it is expected that some 2,500,000 tons of milled peat, usable as patent fuel in briquettes,

will be produced: the present methods of manufacture enable peat with a moisture content up to 55 per cent. to be used so that expenditure on drainage has been steadily reduced. So far, Bord na Mona controls only some 160 square miles of bog though another 450 square miles is under investigation. From the Irish view, all this seems a long-cherished dream coming true—but as yet slowly. Mr. C. S. Andrews, the managing director of Bord na Mona, maintains that past endeavours were "dissipated in the unpropitious social, economic and political climate of their times," and modestly speaks of "beginning the task of turning to profitable use some of the country's waste lands." Three centuries ago Gerald Boate (1652) wished the Cromwellian settlers to do just that: "whoso could drain the water, and for the future prevent the gathering thereof, might reduce more of the bogs in Ireland to firm land and preserve them in that condition," but (the Irish) "let daily more of their good land grow boggy through their own carelessness, whereby also most of the bogs at first were caused."

Whatever his attitude to the Irish, Boate, like many later writers, saw the wisdom of clearing the bogs. But hopes that all the land cleared will be fertile enough at least for forest or pasture are unjustified: given good drainage, much may be so used. Indeed much is so used already, and some cleared bog gives excellent potato soils. But in the extreme west, the removal of bog developed on the bare rock leaves only stone behind.

Direct industrial use of peat has never been successful nor is any such use now contemplated. Sir Robert Kane, whose famous work on the 'Industrial Resources of Ireland' appeared in 1844, wanted to use peat or peat charcoal for iron smelting, but a factory he and others established in 1849 to use peat this way at Kilberry bog, near Athy, was unsuccessful. In 1905 a factory was established on this same bog to manufacture brown wrapping paper from peat, but that also failed. Greater success came to Mr. Hamilton Robb, of Portadown, who until 1920 used hand-won peat in producer gas plants to supply power in his linen factory. The industrial solution came from the maxim of Sir John Purser Griffith "Burn the bog where it is born:" in 1924 he built a power house using peat at Turraun, Co. Offaly, and cut fuel by automatic machines with success. His idea of supplying electricity to the towns of Tullamore, Athlone and Birr was not implemented but it was the basis of modern power-station use. T. W. F

NOTE.—*The information in this note is based on the Annual Reports of the Electricity Supply Board; and S. W. Andrews, "Some precursors of Bord na Mona," Journal of the Statistical and Social Inquiry Society of Ireland*, Vol. 20, 1953–54, pp. 132–55.

## INTER-AFRICAN CONFERENCE FOR SOCIAL SCIENCES

The first Inter-African Conference for Social Sciences met in August 1955 at the headquarters of C.S.A. (Council for the Scientific Study of Africa south of the Sahara) at Bukavu on Lake Kivu in the Belgian Congo. It was attended by about a hundred delegates representing France, Belgium, Portugal, the Union of South Africa, the Federation of Rhodesia and Nyasaland, and Great Britain. Special attention was given to a review of the progress in the various social sciences and to the possibilities of international collaboration in the filling of some of the gaps revealed. Six committees were formed, one of which was concerned with human geography, demography and economics. The geographers present included M. Boleo of Portugal, Professor P. Gourou of the University of Brussels, Dr. J. H. Moolman, Director of the National Resources Planning Board, Pretoria, and R. W. Steel of the University of Oxford. Among the seventy-two recommendations sent by the conference to the six member governments of C.C.T.A. (Council for Technical Co-operation in Africa south of the Sahara), two are of special interest to geographers. One was the proposal that an attempt should be made to compile an atlas showing, in as much detail as possible, examples of the types of land use and settlement in selected areas of about ten square miles in the different geographical regions of Africa. The other recom-

mendation, for which there was much support from other committees of the conference, proposed that the member governments should be asked to prepare and publish maps at a scale of 1/1,000,000 to show the distribution and density of population, according to agreed cartographical methods. It is particularly hoped that the latter proposal will be generally adopted in view of the obvious value of such maps for administrative, economic and many other purposes. R. W. S.

## SOVIET GEOGRAPHICAL SERIALS IN THE SOCIETY'S LIBRARY

BULLETIN (IZVESTIA) OF THE ACADEMY OF SCIENCES OF THE U.S.S.R.: GEOGRAPHICAL SERIES, 1955. No. 3 (July–August). Climatic conditions of atmospheric moisture over continents, by M. I. Budyko. A study of general atmospheric circulation, by A. A. Gira. Basic features of the orography of northern Polar regions, by G. D. Richter. General principles for the formation of valleys of coastal deltas, by V. V. Egorov. Regionalization according to basic economic areas, with special reference to the Buryat–Mongol A.S.S.R., by N. M. Oznobin and S. L. Rozenfeld. Administrative division of regions and economic regions, by G. Naumov. Eighteenth-century maps of the Kara–Bugaz–Gol peninsula, by K. I. Shafranovskii. Study of the Quaternary in Poland, by K. K. Markov. Problems of karst study, by N. I. Nikolaev. Geographical study of botany and agriculture in the West Ukraine, by V. V. Onikienko.

No. 5 (September–October): On the paleogeography of the U.S.S.R., by M. I. Neishtadt. Dynamics of the banks of the Tsimlyansk reservoir, by S. L. Vendrov. Loess of China and their origins, by I. P. Gerasimov. Micro-climatic conditions of the distribution of tea culture in the Kuban, by A. F. Zinina. Some problems of method in physical regionalization, by V. I. Prokaev. Survey of the development of geography in China, by S. Tsin-chi. Contemporary state of geography abroad, by I. A. Meshcheryakov.

BULLETIN (IZVESTIA) OF THE ALL-UNION GEOGRAPHICAL SOCIETY, Vol. 87 (1955). No. 5 (September–October). Tasks and methods of landscape study, by A. G. Isachenko. Problems of landscape regionalization in the south Russian basin, by F. N. Mil'kov. Study of physical complexes in the Zaraisk region, Moscow oblast', by I. N. Tsesel'chuk. Report of a meeting to discuss landscape study at the Geographical Society of the U.S.S.R., held in Leningrad, 15–17 April 1955. The career of V. N. Sukachev, and his contribution towards the development of geobotany and landscape study, by B. V. Sochava. Gifts of foreign geographers to the Geographical Society of the U.S.S.R., on the occasion of the 2nd Congress, February 1955.

No. 6 (November–December). Survey of the physical geography of the Lanchow–Alma Ata railway line region, by V. M. Sinitsyn. Some problems of content and method in field work in economic geography of sparsely-populated areas, by V. V. Pokshishevskii. Natural zones, by A. M. Kanonikov. The Molotov oblast', by N. V. Kliukin. Experience gained in the study of soil erosion by collective methods, by V. P. Lidon and others. The extinct volcanoes Cherkii and Dombrovskii in Eastern Siberia, by N. A. Florenson. Supplementary bibliography of the history of the discovery of Kamchatka, by M. O. Kosven. Conference on problems of astrogeology, by B. L. Lichkov. Conference on 'Sun-earth' problems, by L. A. Vitels. Conference on the study of the Vologodskaia region, by V. I. Veselovskaia. Report of the Geographical Society for 1954.

## CORRECTION

It is regretted that in the *Journal* for December 1955 (p. 517) the title of 'The Isle of Lewis and Harris' by Arthur Geddes was given as 'The Isles of Lewis and Harris.'

# NOTES

HUNTING AEROSURVEYS reported on January 19 that their Antarctic Expedition on behalf of the Governor of the Falkland Islands was ready to take off from its base on Deception Island. P. G. Mott, Survey Director of the company and a Fellow of this Society, is leading an expedition of 46 members—fliers, aerial and ground photographers, surveyors, geophysical technicians, radar and maintenance men. Canso amphibious aircraft are making a 60,000-mile complete aerial survey, to include most of the Graham Land Peninsula and the surrounding island groups, and helicopters, based on the Expedition's ship *Oluf Sven*, will also be used.

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The COVENTRY CITY LIBRARY has published a revised edition of a useful pamphlet on Geography in the series 'Books for further reading by sixth form scholars' (Coventry, 1955, 2*s*). The list contains some 400 titles, conveniently arranged in twenty-six sections, which are available in the city library. It has been carefully compiled, though a few titles which it might reasonably have contained are missing. The inclusion of British geographical periodicals might be considered in future editions. These are minor points, and it is pleasant to know that the requirements of students of geography are so well met by the City.

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The BRITISH COUNCIL, 65 Davies St., W.1, has issued a most useful list of scholarships available abroad in the academic year 1956–7. The grants are for study, at university level, in the country of origin for periods up to a year (though some annual awards may be renewed). Most of the countries listed are in Europe, but Brazil offers two scholarships in any subject at "a university or other institution of higher education," and Iran offers two scholarships at Teheran University for the study of Persian language and literature. The report also contains a summary of grants in Commonwealth countries, Israel and the United States, and gives the addresses from which fuller information may be obtained about these.

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The second ELI SOWERBUTTS MEMORIAL LECTURE, instituted by the Manchester Geographical Society to commemorate its virtual founder, was held in October last. Mr. G. R. Crone spoke on the development of cartography before A.D. 1800.

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It is announced from the Headquarters of U.N.E.S.C.O. in Paris that a research centre for South Asia is to be opened in Calcutta. Ten Asian countries sent delegates to the Advisory Meeting in New Delhi last September, namely Afghanistan, Burma, Ceylon, India, Indonesia, Nepal, Pakistan, Philippines, Thailand and the Malaya–British Borneo group of Associate Member States. The Indian Government will contribute to the upkeep of the organization, which will be known as the Research Centre on the Social Implications of Industrialization in Southern Asia.

* * *

The LE PLAY SOCIETY is running an excursion to Denmark from April 3 to 19, for the purpose of studying archaeology and architecture. It will be based on Aarhus, Odense and Copenhagen. All enquiries should be addressed to Miss Margaret Tatton, c/o The Birlings, Birling Gap, Eastbourne.

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# OBITUARY

## PROFESSOR WILFRED SMITH

It was with very great grief that his many friends heard of the sudden death of Wilfred Smith, John Rankin Professor of Geography in the University of Liverpool, on 27 September 1955, at the age of fifty-two. Characteristically, he died in harness, during a staff meeting in the Department of Geography, to which his working life had been devoted and indeed dedicated.

Wilfred Smith, born in Halifax, was educated at Blackpool Grammar School. From there he went up to the University of Liverpool in 1921 as a Bibby scholar under Professor P. M. Roxby, for whom he had a life-long affection. After a period as a graduate research scholar and tutor, he joined Roxby in 1928 as an assistant lecturer, was promoted to lecturer in 1931, and to senior lecturer in 1945. The logical and well-deserved culmination of his service to the Department and to the University was his election to the John Rankin chair in 1950, an appointment received with acclaim in the geographical world, and with particular joy by his colleagues.

His list of publications is long and varied, the result of his zealous yet meticulous approach to research. His early work, under the influence of Roxby, was concerned with the Far East; in 1926 there appeared 'A geographical study of coal and iron in China,' and he wrote several articles on various aspects of the geography of that country. His chief interests developed in the field of economic geography, notably in the location of industry in Great Britain and in the methodological approach to these lines of enquiry. He was, of course, closely concerned with the study of Lancashire and especially of Merseyside in its various aspects; from 1934 he produced a long series of articles on the agricultural geography of the Fylde, on the cotton industry, and on the distribution of population in Lancashire. In 1941 he wrote the 'Lancashire' volume (part 45) of the Land Utilisation Survey, edited by Professor Stamp, and in 1942 there appeared 'The distribution of population and location of industry in Merseyside.' Four years later his all-round ability revealed itself in 'A physical survey of Merseyside.' The monumental product of years of research was 'An economic geography of Great Britain' (1949)—thorough, scholarly and painstaking, yet eminently readable; its quality is testified by the universally enthusiastic reviews and by the rapid demand for a subsequent edition. In 1953 he edited, and wrote a large part of, 'A scientific study of Merseyside,' published for the Liverpool meeting of the British Association for the Advancement of Science. At the time of his death he was working on a long-term enquiry into 'The journey to work on Merseyside.'

His services to the University of Liverpool were by no means limited to his own Department. For six years he was a special lecturer in the Department of Education, and did much to propagate the successful principles of the teaching of geography in school. He was also keenly aware of the geographer's contribution to planning, as his lectures in the Department of Civic Design and his numerous articles in *The Town Planning Review* and elsewhere clearly indicate.

His qualities as an administrator resulted in his inevitable membership of many committees, and in 1953 he became Dean of the Faculty of Arts, to which task he brought his infinite patience, his capacity for dealing cheerfully with tedious administrative details, and his farsightedness in matters of policy. He was also president of the flourishing Merseyside branch of the Geographical Association, and was president at the time of his death of the Institute of British Geographers, of which he was an original member.

He was a man of quiet kindly charm, and possessed a twinkling sense of humour which contrasted with his modest, sometimes apparently rather grave, manner. His colleagues and students never went to him for help and advice, academic or personal,

without receiving this in full measure; they well realize how much they owe to his guidance and to his example. As a result, his Department was truly a happy community as well as a flourishing one academically. He was particularly interested in overseas students, and devoted much personal attention to them. To his wife, who shared so fully his many interests, departmental and university, we convey our sincere sympathy. F. J. M.

## YANN-MORVRAN GOBLET, D. ès L.

Dr. Y.-M. Goblet, who died in July 1955, at the age of seventy-four, was well known to many British geographers for his work on political and economic geography and especially for his studies on Sir William Petty and the Down Survey. Goblet held a number of appointments, culminating in the chair of the Geography of Transport at the Conservatoire des Arts-et-Métiers, Paris. He was a great traveller and observer, keenly interested in the politics, economics and culture of the countries he visited, and with his wide and accurate knowledge he was well equipped as a correspondent of numerous journals, including *Le Temps* and *Le Monde*. In 1952, as a guest of the Union government, he visited South Africa for the Tercentenary celebrations. The following year he was elected to the Académie des Sciences Coloniales. At his death he was Vice-President of the Société de Géographie Commerciale, and of the Société d'Économie Politique, and an officer of the Légion d'Honneur.

In addition to his magisterial work, 'La transformation de la géographie politique de l'Irlande an XVII$^{e}$ siècle,' he was the author of 'Le crépuscule des traités' and 'Political geography and the World Map,' the latter published in London in the year of his death. Goblet married an Englishwoman and was an admirer of this country. His empirical approach to world problems, developed particularly in his last book, was perhaps testimony to this. On his visits to London he rarely missed visiting the Society, in whose work he took great interest. G. R. C.

## SIR WILLIAM HIMBURY

Sir William Himbury died last November in hospital at Southport at the age of eighty-four. He was a widely travelled man, a former member of the Council, and a Fellow of the Society for sixty-one years. He took great interest in the work of the Geographical Association and for many years, right up to the time of his death, was its highly esteemed Treasurer.

Sir William was in the cotton trade all his life, a pioneer of cotton growing within the Commonwealth, and the first Managing Director of the British Cotton Growing Association; he resigned from the Chairmanship only a few weeks before his death. He was on many government committees, and on boards of management connected with cotton growing, and also with agricultural development within the Commonwealth generally. He was appointed by Lord Milner to serve on a committee to consider the establishment of a college of tropical agriculture in the West Indies, and thus became a member of the Governing Body of the Imperial College of Tropical Agriculture in Trinidad. He held this office until shortly before his death. Sir William Himbury was knighted as long ago as 1926. He was a kindly and generous man; among his friends in many parts of the Commonwealth, and especially the officers of the Geographical Association, he leaves many memories of kindly actions and of advice and help generously given. L. B.

## CAPTAIN JOHN GEORGE DUNLOP, V.D., J.P., F.R.C.I.

John George Dunlop, who died recently in South Africa, became a Fellow of the Society in 1927, and was a life member. Born in 1882 and educated at Raphoe, Co. Donegal, and Dublin, he volunteered while still in his teens for service in the South African War. He joined the first contingent of the South African Constabulary in

Dublin in 1900, served with distinction throughout hostilities, and was awarded the Queen's South African Medal and 5 bars. Captain Dunlop spent most of his life in South Africa and saw active service in many areas—the Zulu Rebellion of 1906 and the campaigns in German South West and German East Africa during the First World War, to mention only a few. He was also a pioneer of aviation, and was decorated in 1924 with the Colonial Long Service Medal in recognition of his many and varied services in his chosen sphere of action.

# CORRESPONDENCE

## The Height of Mount Everest

In an article in the *Journal* of March 1955, Dr. Hunter gives a highly provocative review of my recent 'Technical Paper' on the new height determination of Mount Everest. This review is clothed in an authoritative style, and yet, besides intemperate comments due to confused thinking, it contains a number of serious misstatements. Hunter accuses me of being critical of my predecessors, especially of Burrard. According to him "Burrard was not talking about geoidal heights nor was anyone else at that time." Actually, the situation is the other way round. Neither the data to get spheroidal heights of starting stations nor the plumb line deflections were known in those days, and everybody had perforce to work in more or less geoidal terms, and vague data, although they were generally unaware of it. The work of the pioneers is always tentative, and the fact that some of his ideas have not borne the brunt of time does not alter the fact that Burrard was a profound geodesist.

Hunter has always claimed that he discovered the basic formula for the coefficient of refraction given on page 159 of Bomford's 'Geodesy' (1952), as also the rule for using the value at height one-third of the way along a sloping ray. He refers to the latter as his Law I. In fact, the formula for $k$ one-third the way up was discovered by Helmert in 1879 or so and is given on page 573 of the latter's 'Hoheren Geodesie' (1884). Similarly, the formulae for the curvature of a light ray are classical and were probably discovered in the 1880's and are given in detail by Helmert. Hunter published a table based on this formula and he considers it to be the last word on refraction (5 Sur. in 'Auxiliary Tables,' Survey of India, Part II, 1928). With immense self-assurance, he tells us that when this table is applied to standard conditions of $t$ and $p$ one finds for the rays from the Bengal plains 0·063 and those from Darjeeling hills 0·053, and "with no exaggeration one may say that the refraction problem for long rays to Everest had been solved. The only outstanding difficulty was the geoidal shape for which many more observations were required." If this were correct, then all my efforts to take a special triangulation close to the peak were a waste of time, labour and money. The rays from Bihar plains are 110 miles long with one terminal at about 200 feet, and the other at 29,000 feet, and such rays cannot be dealt with by a simple coefficient of refraction of 0·063, as Dr. Hunter would have us believe. Nature does not admit of such spurious simplicity. Levallois and de Masson d'Autune, who have gone further than anybody else in recent years in the matter of refraction, have chosen an empirical line of approach. Their 'Étude sur la refraction geodeseque' (Paris, 1953) affords an illuminating contrast with the sweeping statements of Dr. Hunter. No theory has emerged yet to cope with refraction on such long rays as were observed in the older Mount Everest observations. The carrying of triangulation to high peaks close to the mountain was thus a necessary step to cut out the uncertainties of refraction. In observing from such elevated points, refraction does not present a serious problem. It is a question of choosing a good representative value of temperature gradient.

Dr. Hunter is very hurt that I have not referred to his figure of 29,149 feet or to his paper "Heights and names of Mount Everest" (Occ. Notes, *R. Ast. Soc.* **3** (1953) 15). This is more or less a replica of his lecture before the Indian Science Congress, Madras, in 1922, and contains the same errors and fallacies. In 1922 the Everest spheroid was defined incompletely in the sense that its separation from the geoid was not specified. Geodetic knowledge had not advanced far enough to make this imperative. Hunter's accepted heights of the stations of observation are by no means spheroidal; in the computations of heights, he neglected deflections at stations in the plains and took wrong values at the two hill stations. How then can his height be reckoned as spheroidal? On top of the above errors, which are different for different stations, the results are burdened with errors due to a major unknown factor—refraction. The rays are ultra-long, observations are not at the time of minimum refraction and no temperatures and pressures are recorded. Hunter's value of 29,149 feet is a confused height obtained from incomplete data. The same is the case with Burrard's 29,141 feet and the older accepted 29,002 feet.

Hunter says, in his *Journal* paper, "Gulatee's 1952–54 observations have given a value of 109 feet for the geoidal rise between Ladnia and Mount Everest. When this is subtracted from Burrard's spheroidal height, the result is 29,032; which accords closely with Gulatee's value of 29,028. All this confirms the opinion held since 1925 that the only outstanding difficulty was assessment of geoidal rise." Hunter thus gives the impression that Burrard's estimate agrees with mine to 1 foot. Dr. Hunter pays me a back-handed compliment by thinking that I have produced a magical figure of 109 feet, which acts as a universal panacea for all older deductions to bring them to the correct value. From Chart V of my paper it will be apparent that the geoidal rise from these stations ranges from 46 feet to 109 feet. But Hunter, without a demur, has chosen the highest figure of 109 feet, simply because it brings the answer close to mine. Furthermore, Burrard's height of 29,141 feet is by no means spheroidal, and any correction to it for the geoidal rise is totally irrelevant. These problems do not permit of such imprecise handling. The older observations are heterogeneous, having been taken under very different conditions, and the derivations based on them contain significant inconsistencies. Each ray has to be considered separately, and applying a collective correction of 109 feet to produce a known answer is absolutely justifiable.

To recapitulate, the following points must be emphasized: 1. 29,002 feet and 29,141 feet are not spheroidal heights above any recognized spheroid, and it is no use attempting to force them to agree with the result formally computed now by applying *ad hoc* corrections to them; it is a case of like not being compared with like. 2. The problem of curvature of rays over 100 miles long from flat plains to stupendous heights, as were used for older observations, is not yet solved, mainly on account of uncertainty of meteorological conditions. Refraction for such long rays is still an uncertain business, Hunter's claims notwithstanding. The only palliative is to go high up close to the mountain, as was done for the new observations.

The problem of determination of heights of high peaks is a complex one and the background for critical evaluation is indispensable to anticipate all possible factors in order to evolve the "best way" of carrying out the task. It is not enough to have gone through a traditional initiation; it is necessary, thereafter, to hew closely to the line, as the changes in the data and the orientations of the spheroids and their interactions with the geoid (brought about from time to time as a result of further knowledge) are confusing and there are other ramifications which can well outstrip the ability of unaided memory. Dr. Hunter's unbalanced innuendos in a journal of high repute are, to say the least, undignified. All is well, however, in that he has not queried my estimation of errors, geoidal rise and the newly derived value of the height of Mount Everest.

B. L. GULATEE

*Survey of India*,
*Dehra Dun*,
7 *November* 1955

### Indo-European Migration

Historians go sadly wrong when they disregard geography, as we have recently seen in Hannibal's story, told by Sir Gavin de Beer.

Another major example comes in that of the Indo-European migration to the West. Milesius is described, in Chronicum Scottorum and the Annals of Clonmacnoise as having led his people from ancient Ariana (now Hari-Rud) to Taprobane. An unfortunate annotation by the Editor of the Master of the Rolls edition of 1866, presumes to say this is "Ceylon." However, a study of Gibbon and other authorities make it very clear that Taprobane is merely a corruption of Atrobatene, the modern Azerbaijan. Then again, after Milesius's service as "General of the Egyptian armies" and his marriage to Scota, his people continued on to Iberia. The seventeenth century translators distort this into Spain, whereas ancient Iberia is in the Caucasus, east of Georgia, north of Armenia and west of the Caspian. Then again, we find the Milesians described as fighting their way through the Goths, the Lombards, the Burgundians and the Frisians to Brigantium, before reaching their goal in Antrim. The British Brigantes of South Yorkshire were directly in their route, a remark which hardly applies to the Brigantium of Galicia which the translators thrust upon us. The story should be of interest today because James V of Scotland is descended from the forty-four High-Kings of the Scoti. He is, of course, Her Majesty's direct ancestor.

I hope these remarks may elicit the opinions and comments of those better qualified than myself.

L. V. S. Blacker

*Cold Hayes, Liss, Hants,*
5 *December* 1955

## MEETINGS: SESSION 1955–56

Meeting of 24 November 1955. Dr. E. W. H. Briault in the Chair

*Films for geography teachers*

Meeting of 5 December 1955. Mr. L. Brooks in the Chair

*Film:* Livingstone's country. Commentary by Major J. Waller

Meeting of 12 December 1955. The President in the Chair

*Elections to Fellowship:* Raymond Adams; Frederick Agama; Eric John Barker; Eric M. Bonner; Burton W. G. Bower; Miss Stella M. Bull; Robert J. H. Chambers; Richard T. V. Clarke; Miss Elinor M. Clinch; Rev. Arthur E. Dalton; Miss Betty M. E. Dass; John J. F. Douglas; Mrs. Julie A. Field; Frederick J. Gardiner; Miss Margaret J. Heath; Miss Mary A. Heath; Donald C. Ireland; David M. James; Brian R. Jones; Norman A. Leonard; Robert Logan; Baldath R. Maharaj; Julian E. H. Mustoe; W. J. E. Norton; Derek Ord; Richard T. Porter; Colin C. Rudeforth; Abdur Hasheed Sheikh; Ian Howden Simpson; Cornelius Tamale; Donald H. Tribe; Alfred D. Uppadine, B.A.; John W. Whitlock; David V. Williams; Gerald A. Wyatt; Sqn. Ldr. J. E. T. Yendall.

*Elections to Associate Membership:* John Francis Dexter; Miss Janey A. Godfree; Miss Christine Harwood; Miss Jennifer W. Illingworth; Miss Alwyn E. James; Miss Josephine King; Miss Josephine Lerpiniere; Miss Anthea J. Miller; Philip Morris; Miss Isabel M. Quinn; Miss Ann Rosemary Sayer; Miss Gwendoline Swindell; Miss Ursula N. H. Ward; Miss Glenys Williams.

*Paper:* The Ordnance Survey and the public. By Major-General J. C. T. Willis

Meeting of 19 December 1955. The President in the Chair

*Paper:* Between two forests. By Professor S. W. Wooldridge and Miss E. M. J. Campbell

Meeting of 3 January 1956. Professor J. A. Steers in the Chair. Joint meeting with the Institute of British Geographers and the Geographical Association

*Paper:* Some medical aspects of geography. By Professor A. L. Banks

Meeting of 9 January 1956. The President in the Chair

*Elections to Fellowship:* Mr. Roman Ian Black, M.A.; Mr. Henry E. Blake; Mr. Geoffrey O. D. Bolton, A.R.P.S., F.R.S.A.; Mr. Robert G. Boston; Mr. Charles J. Buckley; Mr. Ian L. Burr; Mr. Roy Chung; Mr. Donald A. E. Cross, B.A.; Mr. Harold R. J. Davies, B.A.; Mr. William E. Everitt; Mrs. Dora V. Hilder; Rev. Frederick J. Kay, M.A.; Miss Mabel Kay; Mr. Hugh S. A. Kewley; Mr. A. H. Layard, C.S.I., C.I.E.; Mr. Desmond C. O'Connor; Rev. Brother Reginald; Lady Lilith E. M. Savile; Miss Patricia M. Seed; Mr. Frederick A. Smith; Mrs. Vivian Sorsbie; Mr. K. D. Umrigar; Mr. Michael Westmacott; Mr. Frederick G. Wood; Mr. Raza Husain Zaidi

*Elections to Associate Membership:* Mr. Robert D. Balfour; Mr. David P. Billings; Mr. Peter A. Blake; Miss Valerie J. Burns; Miss Carol A. Butterley; Mr. Leonard J. Chuter; Miss Valerie E. Larman; Mr. W. S. W. Nowak; Miss Anna K. Park

*Paper:* Some minor battlefields of Alexander in Asia Minor. By Freya Stark

Meeting of 16 January 1956. Mr. L. Brooks in the Chair

*Film:* Thailand journey. Commentary by Major W. T. Blake

Meeting of 30 January 1956. The President in the Chair

*Elections to Fellowship:* Mr. John T. Andrews; Mr. Deryke G. R. Belshaw; Mr. James K. Boswell; Mr. Peter Brown, B.A.; Mr. Samuel J. Campbell, B.A.; Miss Patricia Coe; Comdr. Francis E. Collins; Mr. F. B. J. Coombes; Mr. Gabriel R. Curti; Mr. James B. Eckersley; Capt. Brett Hilder; Mr. William L. Hodges; Mr. Peter F. Holmes, M.C., B.A.; Mr. Jean-Pierre Judd; Mr. Predman A. Lincoln, Q.C., M.A., B.C.L.; Mr. Ronald J. Lorimer; Mr. Spencer L. Millham; Mr. Derek V. Philcox; Mr. Sidney L. Porter; Mr. Allan N. Reed; Mr. Stanley F. Scardifield; Mr. Lloyd S. Smith; Mr. Paul P. Stough; Mr. Alfred P. Tongue; Mrs. Angela Hall-Watt; Mr. Albert J. F. West, B.SC.

*Elections to Associate Membership:* Miss Gillian M. Burrows; Miss Elizabeth Mensforth; Miss Jillian Thomas

*Paper:* East Africa's ancient past. By Professor Sir Mortimer Wheeler

Meeting of 6 February 1956. Professor J. A. Steers in the Chair

*Paper:* An east coast survey. By W. W. Williams

Meeting of 13 February 1956. Mr. L Brooks in the Chair

*Film:* Shores of the Mediterranean. Commentary by Frank R. Newens

Meeting of 20 February 1956. The President in the Chair

*Elections to Fellowship:* Mr. William P. C. Chambers; Mr. Andrew R. Craigie; Mr. Alexander J. Crosbie; Mr. J. Fenykovi; Mr. William B. Fisher; Mr. A. R. Giles; Mr. Hugh C. Gray; Mr. Laurence G. H. Landon; Miss Joyce I. Magor; Rev. Leslie Millin; Mr. Peter H. Moore; Miss Betty L. Mullineaux; Mr. Robert G. Pettigrew; Miss Beatrice Ruston; Miss Mary A. Shaw, B.A.; Mr. Michael C. Smyth; Mr. A. P. Tewari, M.SC.; Mr. George H. Udoh, B.A.; Mr. Archibald E. Yuill

*Elections to Associate Membership:* Miss K. A. S. Howkins; Mr. C. J. Ragg; Miss H. M. Richardson; Mr. Andrew G. Spaull; Mr. A. C. Tornari; Mr. Edward J. Wilmoth

*Paper:* The changing climate of northern Europe. By Dr. D. J. Crisp.

Meeting of 6 March 1956. Mr. L. Brooks in the Chair

*Film:* South: The original film of Shackleton's Imperial Trans-Antarctic Expedition. Commentary by J. M. Wordie.

# THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

## FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

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The Bye-Laws provide that a candidate for admission to the Fellowship of the Society must be proposed by a Fellow personally known to him and seconded by another Fellow. Further, that a candidate is not eligible until he (or she) is twenty-one years old, unless he holds a Commission in Her Majesty's Forces or he (or she) is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary.

Every Fellow shall be required to pay on election *either* £4 as Entrance Fee and £4 as Annual Subscription for the current year and thereafter an Annual Subscription of £4 due on 1st January in each year; *or* a single compounding fee of £60.

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3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

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A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

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